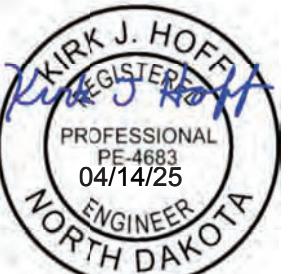


NDDOT ABBREVIATIONS

D-101-1

?	This is a special text character used in the labeling of existing features. It indicates a feature that has an unknown characteristic, potentially based on: lack of description, location accuracy or purpose.	C Gdrl	cable guardrail	Culv	culvert	FOS	factor of safety
		Calc	calculate	C&G	curb & gutter	Fed	Federal
		CIP	cast iron pipe	CI	curb inlet	FP	feed point
		CB	catch basin	CR	curb ramp	Fn	fence
		CRS	cationic rapid setting	C	cut	Fn P	fence post
Abn	abandoned	C Gd	cattle guard	Dd Ld	dead load	FO	fiber optic
Abut	abutment	C To C	center to center	Defl	deflection	FD	field drive
Adj	adjusted	CL or C	centerline	Defm	deformed	F	fill
Aggr	aggregate	Ch	chain	DInt	delineate	FAA	fine aggregate angularity
Ahd	ahead	Chnlk	chain-link	Dlntr	delineator	FH	fire hydrant
ARV	air release valve	Ch Blk	channel block	Depr	depression	Fl	flange
Align	alignment	Ch Ch	channel change	Desc	description	Flrd	flared
Al	alley	Chk	check	Det	detail	FES	flared end section
Alt	alternate	Chsld	chiseled	DWP	detectable warning panel	F Bcn	flashing beacon
Alum	aluminum	Cir	circle	Dtr	detour	FA	flight auger sample
ADA	Americans with Disabilities Act	Cl	class	Dia or ø	diameter	FL	flow line
&	and	CInt	clean-out	Dir	direction	Ftg	footing
Appr	approach	Clr	clear	Dist	distance	FM	force main
Approx	approximate	Cl&gr	clearing & grubbing	DM	disturbed material	Fnd	found
ACP	asbestos cement pipe	Comb.	combination	DB	ditch block	Fdn	foundation
Asph	asphalt	Coml	commercial	DG	ditch grade	Frac	fractional
AC	asphalt cement	Compr	compression	Dbl	double	Frwy	freeway
Assmd	assumed	CADD	computer aided drafting & design	Dn	down	Fr	front
@	at	Conc	concrete	Dwg	drawing	FF	front face
Atten	attenuation	CECB	concrete erosion control blanket	Dr	drive	F Disp	fuel dispenser
ATR	automatic traffic recorder	Cond	conductor	Drwy	driveway	FFP	fuel filler pipes
Ave	Avenue	Const	construction	DI	drop inlet	FLS	fuel leak sensor
Avg	average	Cont	continuous	D	dry density	Furn	furnish/ed
ADT	average daily traffic	CSB	continuous split barrel sample				
		Contr	contraction				
		Contr	contractor				
Bk	back	CP	control point	Ea	each		
BF	back face	Coord	coordinate	Esmt	easement		
Balc	balcony	Cor	corner	E	East		
B Wire	barbed wire	Corr	corrected	EB	Eastbound		
Barr	barricade	CAES	corrugated aluminum end section	Elast	elastomeric		
Btry	battery	CAP	corrugated aluminum pipe	EL	electric locker		
BI	beehive inlet	CMES	corrugated metal end section	E Mtr	electric meter		
Beg	begin	CMP	corrugated metal pipe	EVSE	electric vehicle supply equipment		
BG	below grade	CPVCP	corrugated poly-vinyl chloride pipe	Elec	electric/al		
BM	bench mark	CSES	corrugated steel end section	EDM	electronic distance meter		
Bkwy	bikeway	CSFES	corrugated steel flared end section	Elev or El	elevation		
Bit	bituminous	CSP	corrugated steel pipe	Ellipt	elliptical		
Blk	block	CSTES	corrugated steel traversable end section	Emb	embankment		
BH	bore hole	Co	County	Emuls	emulsion/emulsified		
Bot	bottom	Crse	course	ES	end section		
Blvd	Boulevard	Ct	Court	Engr	engineer		
Bndry	boundary	Xarm	cross arm	ESS	environmental sensor station		
Brkwy	breakaway	Xbuck	cross buck	Eq	equal		
Br	bridge	Xsec	cross sections	Evgr	evergreen		
Bldg	building	Xing	crossing	Exc	excavation		
Bus.	business	Xrd	crossroad	Exst	existing		
BV	butterfly valve	Crn	crown	Exp	expansion		
Byp	bypass			Expy	Expressway		
				E	external of curve		
				Extru	extruded		

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NDDOT ABBREVIATIONS

D-101-2

Galv	galvanized	Ln	lane	Obsc	obscure(d)	Qty	quantity
Gar	garage	Lg	large	Ocpd	occupied	Qtr	quarter
Gs L	gas line	Lat	latitude	Ocpy	occupy		
G Reg	gas line regulator	Lt	left	O/s	offset		
GMV	gas main valve	Lens	lenses	OC	on center	Rad or R	radius
G Mtr	gas meter	Lvl	level	C	one dimensional consolidation	RR	railroad
GSV	gas service valve	Lvng	leveling	OC	organic content	Rlw	railway
GVP	gas vent pipe	Lht	light	Orig	original	Rsd	raised
GV	gate valve	LP	light pole	O To O	out to out	RC	rapid curing
Ga	gauge	Ltg	lighting	OD	outside diameter	Rec	record
Gov	government	Liq	liquid	OH	overhead	Rcy	recycle
Grd	graded/grade	LL	liquid limit			RAP	recycled asphalt pavement
Grnd	ground	Loc	location	PMT	pad mounted transformer	RPCC	recycled portland cement concrete
GWM	ground water monitor	Long.	longitude	Pg	pages	Ref	reference
Gdrl	guardrail	Lp	loop	Pntd	painted	R Mkr	reference marker
Gtr	gutter	LD	loop detector	Pr	pair	RM	reference monument
		Lum	luminaire	Pnl	panel	RP	reference point
				Pk	park	Refl	reflectorized
H Plg	H piling			PSD	passing sight distance	RCB	reinforced concrete box
Hdwl	headwall	Mb	mailbox	Pvmt	pavement	RCES	reinforced concrete end section
Ht	height	ML	main line	Ped	pedestal	RCFES	reinforced concrete flared end section
Hel	helical	MH	manhole	Ped	pedestrian	RCP	reinforced concrete pipe
HDPE	high density polyethylene	Mkd	marked	PPP	pedestrian pushbutton post	RCPS	reinforced concrete pipe sewer
HM	high mast	Mkr	marker	Pen.	penetration	RCTES	reinforced concrete traversable end section
HP	high pressure	Mkg	marking	Perf	perforated	Reinf	reinforcement
HPS	high pressure sodium	MA	mast arm	Per.	perimeter	Res	reservation
HTCG	high tension cable guardrail	Matl	material	Perm	permanent	Res	residence
Hwy	highway	Max	maximum	PL	pipeline	Ret	retaining
Hor	horizontal			PI	place	Rev	reverse
HBP	hot bituminous pavement	Meas	measure	P&P	plan & profile	Rt	right
HMA	hot mix asphalt	Mdn	median	PL	plastic limit	R/W	right of way
Hyd	hydrant	MD	median drain	PI or P	plate	Riv	river
Ph	hydrogen ion content	MC	medium curing	Pt	point	Rd	road
		MGS	Midwest Guardrail System	PE	polyethylene	Rdbo	road bed
		MM	mile marker	PVC	polyvinyl chloride	Rdw	roadway
Id	identification	MP	mile post	PCC	Portland Cement concrete	RWIS	roadway weather information system
Incl	inclinometer tube	Min	minimum	PP	power pole	Rk	rock
IMH	inlet manhole	Misc	miscellaneous	Preempt	preemption	Rt	route
ID	inside diameter	Mon	monument	Prefab	prefabricated		
Inst	instrument	Mnd	mound	Prfmd or Pref	preformed		
Intchg	interchange	Mtbl	mountable	Prep	preperation		
Intmdt	intermediate	Mtd	mounted	Press.	pressure		
Intscn	intersection	Mtg	mounting	PRV	pressure relief valve		
Inv	invert	Mk	muck	Prestr	prestressed		
IP	iron pipe			Pvt	private		
				PD	private drive		
Jt	joint			Prod.	production/produce		
Jct	junction	Neop	neoprene	Prog	programmed	07-01-14	
		Ntwk	network	Prop.	property	REVISIONS	
		N	North	Ppsd	proposed	DATE	CHANGE
		NE	Northeast	PB	pull box	08-03-15	General Revisions
		NW	Northwest			04-23-18	General Revisions
		NB	Northbound			12-18-20	General Revisions
		No. or #	number			08-16-22	General Revisions
						04-14-25	General Revisions

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NDDOT ABBREVIATIONS

D-101-3

Salv	salvage(d)	Tel	telephone
San	sanitary sewer line	Tel B	Telephone Booth
Sec	section	Tel P	telephone pole
SL	section line	Tv	television
Sep	separation	Temp	temperature
Seq	sequence	Temp	temporary
Serv	service	TBM	temporary bench mark
Sht	sheet	T	thinwall tube sample
Shtng	sheeting	Ts	topsoil
Shldr	shoulder	Traf	traffic
Sw or Sdwk	sidewalk	TSCB	traffic signal control box
SD	sight distance	Tr	trail
SN	sign number	Transf	transformer
Sig	signal	Trans	transition
Sgl	single	TT	transmission tower
SRCP	slotted reinforced concrete pipe	TES	traversable end section
SC	slow curing	Trans	transverse
SS	slow setting	Trtd	treated
Sm	small	Trmt	treatment
S	South	Qc	triaxial compression
SE	Southeast	TERO	tribal employment rights ordinance
SW	Southwest	Tpl	triple
SB	Southbound	Typ	typical
Sp	spaces		
Spcl	special		
SA	special assembly	Qu	unconfined compressive strength
SP	special provisions	Ugrnd	underground
G	specific gravity	Util	utility
Spk	spike		
SB	split barrel sample	VG	valley gutter
SH	sprinkler head	Vap	vapor
SV	sprinkler valve	Vert	vertical
Sq	square	VCP	vitrified clay pipe
Stk	stake	Vol	volume
Std	standard	VSFS	vehicle speed feedback sign
N	standard penetration test		
Std Specs	standard specifications	Wkwy	walkway
Stm L	steam line	W	water content
SEC	steel encased concrete	WGV	water gate valve
SMA	stone matrix asphalt	WL	water line
SSD	stopping sight distance	WM	water main
SD	storm drain	WMV	water main valve
St	street	W Mtr	water meter
SPP	structural plate pipe	WSV	water service valve
SPPA	structural plate pipe arch	WW	water well
Str	structure	Wrng	wearing
Subd	subdivision	WIM	weigh in motion
Sub	subgrade	W	west
Sub Prep	subgrade preperation	WB	westbound
Ss	subsoil	Wrng	wiring
SS	supplement specification	W/	with
Supp	supplemental	W/o	without
Surf	surfacing		
Surv	survey		
Sym	symmetrical		

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NDDOT ABBREVIATIONS

D-101-4

MEASUREMENTS

ac	acres
A	ampere
Bd Ft	board feet
Cd	candela
cm	centimeter
C	coulomb
CF	cubic feet
m3	cubic meter
m3/s	cubic meters per second
CY	cubic yard
CY/mi	cubic yards per mile
D or Deg	degree
F	Fahrenheit
F	farad
ft	feet/foot
Gal	gallon
G	giga
Ha	hectare
H	henry
Hz	hertz
hr	hour(s)
in.	inch
J	joule
K	kelvin
kN	kilo newton
kPa	kilo pascal
kg	kilogram
kg/m3	kilogram per cubic meter
km	kilometer
K	Kip(s)
LF	linear foot
L	litre
Lm	lumen
L sum	lump sum
Lx	lux
M Hr	man hour
M	mega
m	meter
m/s	meters per second
mi	mile
mL	milliliter
mm	millimeter
mm/hr	millimeters per hour
n	nano
N	newton
Pa	pascal
lb	pounds
sec	seconds
S	siemens
SF	square feet
km2	square kilometer
m2	square meter
SY	square yard
Sta Yd	station yards
SI	Systems International

T	tesla
T/mi	tons per mile
V	volt
W	watt
Wb	weber

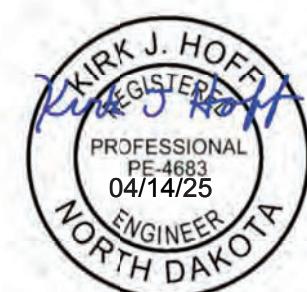
SURVEY DESCRIPTIONS

Az	azimuth
Bs	backsight
Brg	bearing
BP Cap	blue plastic cap
BS	both sides
BC	brass cap
CC	closing corner
CS	curve to spiral
Eq	equation
E	external of curve
FS	far side
FB	field book
Fs	foresight
Geod	geodetic
GIS	Geographical Information System
GPS	Global Positioning System
HI	height of instrument
IM	iron monument
I Pn	iron pin
LS	Land Surveyor (licensed)
LSIT	Land Surveyor In Training
L	length of curve
LC	long chord
LB	level book
MC	meander corner
Mer	meridian
M	mid ordinate of curve
NGS	National Geodetic Survey
NS	near side
Obsn	observation
Off Loc	office location
OP Cap	orange plastic cap
PK	Parker-Kalon nail
P Cap	plastic cap
PP Cap	pink plastic cap
PCC	point of compound curve
PC	point of curve
PI	point of intersection
PRC	point of reverse curvature
PT	point of tangent
POC	point on curve
POT	point on tangent
RTP	random traverse point
Rge	range
RP Cap	red plastic cap
SC	spiral to curve
SC	standard corner
ST	spiral to tangent
Sta	station
SE	superelevation
Tan	tangent
T	tangent (semi)
TS	tangent to spiral
Twp	township
TB	transit book
TP	traverse point
TP	turning point
USC&G	US Coast & Geodetic Survey
USGS	US Geologic Survey
VC	vertical curve
WC	witness corner
WGS	World Geodetic System
YP Cap	yellow plastic cap
Z	zenith

SOIL TYPES

Cl	clay
Cl F	clay fill
Cl Hvy	clay heavy
Cl Lm	clay loam
Co S	coal slack
C Gr	coarse gravel
CS	coarse sand
FS	fine sand
Gr	gravel
Lig Co	lignite coal
Lig Sl	lignite slack
Lm	loam
Rk	rock
Sd	sand
Sdy Cl	sandy clay
Sdy Cl Lm	sandy clay loam
Sdy Fl	sandy fill
Sdy Lm	sandy loam
Sc	scoria
Sh	shale
Si Cl	silt clay
Si Cl Lm	silty clay loam
Si Lm	silty loam

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NDDOT UTILITY COMPANY AND ORGANIZATION ABBREVIATIONS

D-101-10

702COM	702 Communications	GTR RAMSEY WD	Greater Ramsey Water District	RED RIV COMM	Red River Communications
ACCENT	Accent Communications	GT PLNS NAT GAS	Great Plains Natural Gas Company	RESVTN TEL	Reservation Telephone
AGASSIZ WU	Agassiz Water Users District	HALS TEL	Halstad Telephone Company	ROBRTS TEL	Roberts Company Telephone
AGC	Associated General Contractors of America	IDEA1	Idea1	R-RIDER ELEC	Roughrider Electric Cooperative
ALL PL	Alliance Pipeline	INT-COMM TEL	Inter-Community Telephone Company	RRVW	Red River Valley & Western Railroad
ALL SEAS WU	All Seasons Water Users District	KANEPL	Kaneb Pipeline Company	S CENT REG WD	South Central Regional Water District
AMOCO PI	Amoco Pipeline Company	KEM ELEC	Kem Electric Cooperative Incorporated	SE WU	Southeast Water Users Incorporated
AMRDA HESS	Amerada Hess Corporation	KOCH GATH SYS	Koch Gathering Systems Incorporated	SCOTT CABLE	Scott Cable Television Dickinson
AT&T	AT&T Corporation	LKHD PL	Lakehead Pipeline Company	SHERDN ELEC	Sheridan Electric Cooperative
B PAW	Bear Paw Energy Incorporated	LWR YELL R ELEC	Lower Yellowstone Rural Electric	SHEYVN VLY ELEC	Sheyenne Valley Electric Cooperative
BAKER ELEC	Baker Electric	LUMEN	Lumen Technologies Incorporated	SKYTECH	Skyland Technologies Incorporated
BASIN ELEC	Basin Electric Cooperative Incorporated	MCKNZ CON	McKenzie Consolidated Telcom	SLOPE ELEC	Slope Electric Cooperative Incorporated
BEK TEL	Bek Communications Cooperative	MCKNZ ELEC	McKenzie Electric Cooperative	SOURIS RIV TELCOM	Souris River Telecommunications
BELLE PL	Belle Fourche Pipeline Company	MCKNZ WRD	McKenzie County Water Resource District	ST WAT COMM	State Water Commission
BLM	Bureau of Land Management	MCLEOD	McLeod USA	STATE LN WATER	State Line Water Cooperative
BNSF	Burlington Northern Santa Fe Railway	MCLN ELEC	McLean Electric Cooperative	STER ENG	Sterling Energy
BOEING	Boeing	MCLN-SHRDN R WAT	McLean-Sheridan Rural Water District	STUT RWD	Stutsman Rural Water District
BRNS RWD	Barnes Rural Water District	MDU	Montana-dakota Utilities	SW PL PRJ	Southwest Pipeline Project
BURK-DIV ELEC	Burke-Divide Electric Cooperative	MIDCO	MidContinent Communications	SWWA	Southwest Water Authority
BURL WRD	Burleigh County Water Resource District	MIDSTATE TEL	Midstate Telephone Company	SUNOCO	Sunoco LP
CABLE ONE	Cable One	MINOT CABLE	Minot Cable Television	T M C	Turtle Mountain Communications
CABLE SERV	Cable Services	MINOT TEL	Minot Telephone Company	TCI	TCI of North Dakota
CAP ELEC	Capital Electric Cooperative Incorporated	MISS VALL COMM	Missouri Valley Communications Incorporated	TESORO HGH PLNS PL	Tesoro High Plains Pipeline
CASS CO ELEC	Cass County Electric Cooperative	MISS W W S	Missouri West Water System	TRI-CNTY WU	Tri-County Water Users Incorporated
CASS RWU	Cass Rural Water Users District	MNKOTA PWR	Minnkota Power	TRL CO WRD	Trall County Water Resource District
CAV ELEC	Cavalier Rural Electric Cooperative	MOR-GRAN-SOU ELEC	Mor-gran-sou Electric Cooperative	UNTD TEL	United Telephone
CBLCOM	Cablecom Of Fargo	MOUNT-WILLIELEC	Mountrail-williams Electric Cooperative	UPPR SOUR WD	Upper Souris Water District
CENEX PL	Cenex Pipeline	MLGC	Moore & Liberty - Griggs County	US SPRINT	U.S. Sprint
CENT PL WATER DIST	Central Pipe Line Water District	MUNICIPAL	City Water And Sewer	USAF MSL CABLE	U.S.A.F. Missile Cable
CENT PWR ELEC	Central Power Electric Cooperative	MUNICIPAL	City Of '.....'	USFWS	US Fish and Wildlife Service
CENTURYLINK	CenturyLink	N CENT ELEC	North Central Electric Cooperative	USW COMM	U.S. West Communications
COE	Corps of Engineers	N PRAIR REG WD	North Prairie Regional Water District	VRNDRY ELEC	Verendrye Electric Cooperative
CONS COMM	Consolidated Communications	ND PKS & REC	North Dakota Parks And Recreation	W RIV TEL	West River Telephone Incorporated
CONS TELCOM	Consolidated Telcom	ND TEL	North Dakota Telephone Company	WAPA	Western Area Power Administration
CONT RES	Continental Resource Inc	NDDDOT	North Dakota Department of Transportation	WAWSA	Western Area Water Supply Authority
CPR	Canadian Pacific Railway	NE REG WD	Northeast Regional Water District	WEB	W. E. B. Water Development Association
D O E	Department Of Energy	NDSU SOIL SCI DEPT	NDSU Soil Science Department	WILLI WRD	Williams County Water Resource District
DAK CARR	Dakota Carrier Network	NEMONT TEL	Nemont Telephone	WILSTN BAS PL	Williston Basin Interstate Pipeline Company
DAK CENT TEL	Dakota Central Telephone	NODAK R ELEC	Nodak Rural Electric Cooperative	WLSH RWD	Walsh Water Rural Water District
DAK RWD	Dakota Rural Water District	NOON FRMS TEL	Noonan Farmers Telephone Company	WOLVRTN TEL	Wolverton Telephone
DGC	Dakota Gasification Company	NPR	Northern Plains Railroad	XLENER	Xcel Energy
DICKEY R NET	Dickey Rural Networks	NSP	Northern States Power	YSVR	Yellowstone Valley Railroad
DICKEY WRD	Dickey County Water Resource District	NTHN BRDR PL	Northern Border Pipeline		
DICKEY TEL	Dickey Telephone	NTHN PLNS ELEC	Northern Plains Electric Cooperative Incorporated		
DNRR	Dakota Northern Railroad	NTHWSTRN REF	Northwestern Refinery Company		
DOME PL	Dome Pipeline Company	NW COMM	Northwest Communication Cooperation		
DVELEC	Dakota Valley Electric Cooperative	NWRWD	Northwest Rural Water District		
DVMW	Dakota, Missouri Valley & Western	ONEOK	Oneok gas		
E CENT REG WD	East Central Water District	OSHA	Occupational Safety and Health Administration		
ENBRDG	Enbridge Pipelines Incorporated	OTTR TL PWR	Otter Tail Power Company		
ENVENTIS	Enventis Telephone	PAAP	Plains All American Pipeline		
EQUINOR	Equinor Pipeline	P L E M	Prairielands Energy Marketing		
FALK MNG	Falkirk Mining Company	POLAR COM	Polar Communications		
FHWA	Federal Highway Administration	PVT ELEC	Private Electric		
G FKS-TRL WD	Grand Forks-trail Water District	QWEST	Qwest Communications		
GETTY TRD & TRAN	Getty Trading & Transportation	R&T REG WD	R & T Water District		
GLDN W ELEC	Golden West Electric Cooperative				

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LINE STYLES

D-101-20

Existing Topography

Void — Void — Void — v Existing Ground Void

—+—+— Existing Cemetery Boundary

----- Existing Box Culvert Bridge

----- Existing Concrete Surface

----- Existing Drainage Structure

----- Existing Gravel Surface

----- Existing Riprap

----- Existing Dirt Surface

----- Existing Asphalt Surface

----- Existing Tie Point Line

----- Existing Railroad Centerline

----- Existing Guardrail Cable

----- Existing Guardrail Metal

----- Existing Edge of Water

----- Existing Fence

----- Existing Railroad

----- Existing Field Line

----- Exst Flow

----- Existing Curb

----- Existing Valley Gutter

----- Existing Driveway Gutter

----- Existing Curb and Gutter

----- Existing Mountable Curb and Gutter

----- Existing 3-Cable w Posts

----- Site Boundary

----- Existing Berm, Dike, Pit, or Earth Dam

----- Existing Ditch Block

----- Existing Tree Boundary

----- Existing Brush or Shrub Boundary

----- Existing Retaining Wall

----- Existing Planter or Wall

----- Existing W-Beam Guardrail with Posts

----- Existing Railroad Switch

----- Gravel Pit - Borrow Area

----- Existing Wet Area-Vegetation Break

----- Existing High Tension Cable Guardrail

----- Existing High Tension Cable Guardrail with Posts

Proposed Topography

----- 3-Cable w Posts

----- Flow

----- Fence

----- REMOVE REMOVE Remove Line

----- Wall

----- Retaining Wall (Plan View)

----- W-Beam w Posts

----- High Tension Cable Guardrail with Posts

Existing Utilities

----- E Existing Electrical

----- FO Existing Fiber Optic Line

----- FO Existing TV Fiber Optic

----- G Existing Gas Pipe

----- OH Existing Overhead Utility Line

----- P Existing Power

----- PL Existing Fuel Pipeline

----- PL Existing Undefined Above Ground Pipe Line

----- SAN Existing Sanitary Sewer

----- SAN FM Existing Sanitary Force Main

----- SD Existing Storm Drain

----- SD FM Existing Storm Drain Force Main

----- Existing Culvert

----- T Existing Telephone Line

----- TV Existing TV Line

----- W Existing Water or Steam Line

----- Existing Under Drain

----- Existing Slotted Drain

----- Existing Conduit

----- Existing Conductor

----- Existing Down Guy Wire Down Guy

----- Existing Underground Vault or Lift Station

Proposed Utilities

----- 24 Inch Pipe

----- Reinforced Concrete Pipe

----- Under Drain

----- Edge Drain

Traffic Utilities

----- Conductor

----- Fiber Optic

----- Existing Loop Detector

----- Existing Double Micro Loop Detector

----- Micro Loop Detector Double

----- Existing Micro Loop Detector

----- Micro Loop Detector

----- Signal Head with Mast Arm

----- Existing Signal Head with Mast Arm

Sign Structures

----- Existing Overhead Sign Structure

----- Existing Overhead Sign Structure Cantilever

----- Overhead Sign Structure Cantilever

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LINE STYLES

D-101-21

Right Of Way

-----	Easement
-----	Existing Easement
-----	Right of Way
-----	Existing Right of Way
-----	Existing Right of Way Railroad
-----	Existing Right of Way Not State Owned
-----	Existing Government Lot Line
.....	Existing Adjacent Block Lines

Cross Sections and Typicals

-----	Existing Ground
-----	Existing Topsoil (Cross Section View)
void — void — void — v	Existing Ground Void (Not Surveyed)
-----	Existing Concrete
-----	Existing Aggregate (Cross Section View)
-----	Existing Curb and Gutter (Cross Section View)
-----	Existing Asphalt (Cross Section View)
-----	Existing Reinforcement Rebar

Striping

-----	Centerline Pavement Marking
=====	Barrier with Centerline Pavement Marking
=====	Barrier Pavement Marking
- - - - -	Stripe 4 IN Dotted Extension White
- - - - -	Stripe 8 IN Dotted Extension White
- - - - -	Stripe 8 IN Lane Drop

Erosion Control

.....	Limits of Const Transition Line
.....	Bale Check
.....	Rock Check
-----	Floating Silt Curtain
-----	Silt Fence
.....	Excavation Limits
-----	Fiber Rolls

Geotechnical

-----	Geotextile Fabric Type D
Geo — Geo —	Geogrid
-----	Geotextile Fabric Type R
-----	Geotextile Fabric Type R1
RR — RR —	Geotextile Fabric Type RR

Pavement Joints

*****	Doweled Joint
+++++	Tie Bar 30 Inch 4 Foot Center to Center
+++++	Tie Bar 18 Inch 3 Foot Center to Center
+++++	Tie Bar at Random Spacing

Environmental

-----	Wetland Mitigation
*** *** *** ***	Existing Wetland Easement USFWS
-----	Existing Wetland Jurisdictional
-----	Existing Wetland
-----	Tree Row

Boundary Control

Existing City Corporate Limits or Reservation Boundary

Existing State or International Line

Existing Township

Existing County

Existing Section Line

Existing Quarter Section Line

Existing Sixteenth Section Line

Existing Centerline

Tangent Line

Contours

-----	Depression Contours
-----	Supplemental Contour

Profile

-----	Subgrade, Subcut or Ditch Grade
-----	Topsoil Profile

Bridge Details

-----	Small Hidden Object
-----	Large Hidden Object
-----	Phantom Object
-----	Existing Conditions Object
-----	Centerline Main
-----	Centerline Secondary
-----	Excavation Limits
-----	Proposed Ground
-----	Sheet Piling

NORTH DAKOTA	
DEPARTMENT OF TRANSPORTATION	
07-01-14	
REVISIONS	
DATE	CHANGE
09-23-16 12-18-20	Added and Revised Items, Organized by Functional Groups General Revisions



SYMBOLS

D-101-30

	North Arrow (Half Scale)
	Alignment Data Point
	Alignment Monument
	Spot Elevation
	Existing Miscellaneous Spot
	Existing Access Control Arrow
	Existing Benchmark
	Reset USGS Marker
	Iron Monument Found
	Iron Pin R/W Monument
	Property Corner
	Iron Pin Reference Monument
	Right of Way Marker (Exst, Ppsd, Reset)
	Existing Federal Reference Corner
	Existing Section Corner (Full, Quarter, Sixteenth, Meander)
	Existing Witness Corner
	Existing Control Point (CP, GPS-RTK, TRI)
	Existing Traverse PI Aerial Panel
	Existing Reference Marker Point NGS
	Existing EFB Misc
	Existing Bush or Shrub
	Existing Large Evergreen Tree
	Existing Small Evergreen Tree
	Existing Large Tree
	Existing Small Tree
	Existing Tree Trunk
	Cairn or Stone Circle
	Existing Artifact
	Existing Satellite Dish
	Existing Weather Station
	Existing Windmill or Tower
	Reinforced Pavement
	Continuous Split Barrel Sample
	Flight Auger Sample
	Split Barrel Sample
	Thinwall Tube Sample
	Standard Penetration Test
	Inclinometer Tube
	Excavation Unit
	Existing Ground Water Well Bore Hole

NORTH DAKOTA	
DEPARTMENT OF TRANSPORTATION	
07-01-14	
REVISIONS	
DATE	CHANGE
12-18-20	General Revisions

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 ENGINEER
 NORTH DAKOTA
 12 18 2020

SYMBOLS

D-101-31

■	Flexible Delineator	■	Highway Sign (Exst, Ppsd)
□ □	Flexible Delineator Type A (Exst, Ppsd)	□ □	Mile Post Type A (Exst-Ppsd-Reset)
□ □	Flexible Delineator Type B (Exst, Ppsd)	□ □	Mile Post Type B (Exst, Ppsd)
□ □	Flexible Delineator Type C (Exst, Ppsd)	□ □	Mile Post Type C (Exst, Ppsd)
○ ○	Flexible Delineator Type D (Exst, Ppsd)	○ ○	Object Marker Type I (Exst, Ppsd)
○ ○	Flexible Delineator Type E (Exst, Ppsd)	○ ○	Object Marker Type II (Exst, Ppsd)
└ └ └ └	Delineator Type A (Exst, Ppsd, Diamond Grade-Reset)	└ └	Object Marker Type III (Exst, Ppsd)
└ └ └ └	Delineator Type B (Exst, Ppsd, Diamond Grade-Reset)	○	Existing Reference Marker
└ └ └ └	Delineator Type C (Exst, Ppsd, Diamond Grade)	○—○	Road Closure Gate 18 Ft (Exst, Ppsd)
○ ○ ○	Delineator Type D (Exst, Ppsd, Diamond Grade)	○—○	Road Closure Gate 28 Ft (Exst, Ppsd)
○ ○ ○	Delineator Type E (Exst, Ppsd, Diamond Grade)	○—○	Road Closure Gate 40 Ft (Exst, Ppsd)
└ └ └	Barricade (Type I, Type II, Type III)	□	Existing Railroad Battery Box
○ ○ ○	Arrow Panel (Caution Mode, Double Direction, Left Directional, Right Directional, Sequencing, Truck Mounted)	×	Existing RR Profile Spot
△	Attenuation Device	×	Existing Railroad Crossbuck
☒	Truck Mounted Attenuator	×	Existing Railroad Frog
●	Delineator Drums	—	Existing Mailbox (Private, Federal)
□	Flagger		
←	Tubular Marker		
▲	Traffic Cone		
---	Back to Back Vertical Panel Sign		

NORTH DAKOTA	
DEPARTMENT OF TRANSPORTATION	
07-01-14	
REVISIONS	
DATE	CHANGE
12-18-20	General Revisions



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 12 18 2020

SYMBOLS

D-101-32

	Existing Luminaire			High Mast Light Standard 3 Luminaire (Exst, Ppsd)			Existing Traffic Signal Standard
	Luminaire LED			High Mast Light Standard 4 Luminaire (Exst, Ppsd)			Pull Box (Exst-Ppsd-Undefined)
	Existing Light Standard Luminaire			High Mast Light Standard 5 Luminaire (Exst, Ppsd)			Intelligent Transportation Pull Box (Exst, Ppsd)
	Relocate Light Standard			High Mast Light Standard 6 Luminaire (Exst, Ppsd)			Transformer (Exst, Ppsd)
	Light Standard Light LED Luminaire			High Mast Light Standard 7 Luminaire (Exst, Ppsd)			Power Pole (Exst-Ppsd-with Transformer)
	Light Standard 35 Watt High Pressure Sodium Vapor Luminaire			High Mast Light Standard 8 Luminaire (Exst, Ppsd)			Wood Pole (Exst, Ppsd)
	Light Standard 50 Watt High Pressure Sodium Vapor Luminaire			High Mast Light Standard 9 Luminaire (Exst, Ppsd)			Pedestrian Push Button Post (Exst, Ppsd)
	Light Standard 70 Watt High Pressure Sodium Vapor Luminaire			High Mast Light Standard 10 Luminaire (Exst, Ppsd)			Existing Pole
	Light Standard 100 Watt High Pressure Sodium Vapor Luminaire			Overhead Sign Structure Load Center (Exst, Ppsd)			Existing Telephone Pole
	Light Standard 150 Watt High Pressure Sodium Vapor Luminaire			Traffic Signal Controller (Exst, Ppsd)			Existing Post
	Light Standard 200 Watt High Pressure Sodium Vapor Luminaire			Pad Mounted Traffic Signal Controller (Exst, Ppsd)			Connection Conductor (Ground, Neutral, Phase 1, Phase 2)
	Light Standard 250 Watt High Pressure Sodium Vapor Luminaire			Flashing Beacon (Exst, Ppsd)			
	Light Standard 310 Watt High Pressure Sodium Vapor Luminaire			Concrete Foundation (Exst, Ppsd)			
	Light Standard 400 Watt High Pressure Sodium Vapor Luminaire			Pipe Mounted Flasher (Exst, Ppsd)			
	Light Standard 700 Watt High Pressure Sodium Vapor Luminaire			Pad Mounted Feed Point (Exst, Ppsd)			
	Light Standard 1000 Watt High Pressure Sodium Vapor Luminaire			Pipe Mounted Feed Point with Pad (Exst, Ppsd)			
	Emergency Vehicle Detector			Pole Mounted Feed Point (Exst, Ppsd)			
	Video Detection Camera			Junction Box (Exst, Ppsd)			
				Existing Pedestrian Head with Number			
				Existing Signal Head			
				Pole Mounted Head			
				Existing Lighting Standard Pole			

NORTH DAKOTA	
DEPARTMENT OF TRANSPORTATION	
07-01-14	
REVISIONS	
DATE	CHANGE
12-18-20	General Revisions



SYMBOLS

D-101-33

○ ○ ○	Existing Manhole (Electrical, Gas, Telephone)	Cap or Stub Exst Gas, Exst Sanitary, Exst Storm Drain, Ppsd Storm Drain, Exst Water
○ ○ ○	Water Manhole (Exst, Exst with Valve)	□ □ □ □ □
○ ○ ○	Sanitary Sewer Manhole (Exst, Ppsd, Exst with Valve)	Existing Pedestal Electrical, Telephone, Fiber Optic Telephone, TV, Fiber Optic TV, Undefined
○ ○ ○	Sanitary Force Main Manhole (Exst, Ppsd, Exst with Valve)	□ □ □ □ □ □
○ ○ ○	Storm Drain Manhole (Exst, Ppsd, Exst with Inlet, Ppsd with Inlet)	Existing Pipe Vent Gas, Fuel, Sanitary, Storm Drain, Water, Undefined
○ ○ ○	Force Main Storm Drain Manhole (Exst, Exst with Valve)	□ □ □ □ □ □
○ ○ ○	Manhole (Ppsd, Ppsd 48 Inch, Exst Undefined)	Valve Exst Gas, Exst Water, Ppsd Water, Exst Undefined
○ ○ ○	Existing Water Appurtenance	○ ○ ○ ○
○ ○ ○	Sprinkler Head (Exst, Ppsd)	Pump Sanitary, Storm Drain, Exst Water
○ ○ ○	Fire Hydrant (Exst, Ppsd)	○ ○ ○
○ ○ ○	Cleanout (Exst Sanitary, Underdrain)	Corrugated Metal End Section (18, 24, 30, 36, 42, 48, 54, 60 Inch)
○ ○ ○	Existing Catch Basin Inlet (Round, Square)	□ □ □ □ □ □ □ □
○ ○ ○	Existing Curb Inlet (Round, Square)	Reinforced Concrete End Section (18, 24, 30, 36, 42, 48, 54, 60 Inch)
○ ○ ○	Existing Slotted Reinforced Concrete Pipe	□ □ □ □ □ □ □
○ ○ ○	Catch Basin (Riser 30 Inch, Beehive, Type A)	
○ ○ ○	Inlet Mountable Curb (Type A, Type B)	Existing Utility Marker
○ ○ ○	Inlet Saddle Base (Type 1, Type 2)	□ Existing Meter
○ ○ ○	Inlet Special (Catch Basin, Type 1, Type A)	□ Existing Fuel Dispensers
○ ○ ○	Inlet (Tee, Type 1, Type 2, Type 2 Double)	□ Existing Fuel Filler Pipes
○ ○ ○	Median Drain	○ Existing Fuel Leak Sensors
○ ○ ○	Headwall (Exst, Ppsd, Ppsd Single with Vegetation Barrier, Ppsd Double with Vegetation Barrier)	

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07-01-14	
REVISIONS	
DATE	CHANGE
12-18-20	General Revisions Sheet added - Continued from D-101-32



Cross Section Legend

D-101-40

Description	Longitudinal Parallel to Roadway	Transverse Perpendicular to Roadway*	Description	Longitudinal Parallel to Roadway	Transverse Perpendicular to Roadway*	Light Standard - Multiple Variations	Pole - Multiple Variations
Cable Line				OHT1	OHT2	Concrete Steel Wood with Traffic Signal	Utility Brace Feed Point Guy Power Power Structure Power with Light Power with Transformer
Conduit Line							
Electric Line							
Fiber Optic Line							
Gas Main Line				OH1	OH2		
Gas Service Line							
Gas Transmission Line							
Fuel Pipeline							
Sanitary Sewer Force Main							
Sanitary Sewer							
Steam Line							
Storm Drain (Assumed Depth)	SD1	SD2					
Telephone Line	T1	T2					
TV Line	TV1	TV2					
Water Main Line	WM1	WM2					
Water Service Line	WS1	WS2					

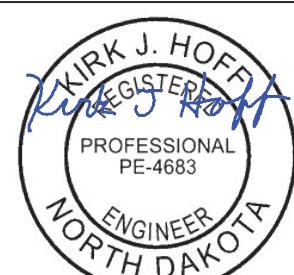
* Usually the transverse utilities are shown on a cross section with 2 or more symbols. The utility runs from one symbol to the other, but the connection may not be shown.

Connection to infer that probably will not be displayed

When storm drain invert elevations are NOT used to draw pipe, they will appear as shown to the left. When invert elevations are used to draw pipe, they will be a cross section similar to the graphics shown below.



NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-20-18	
REVISIONS	
DATE	CHANGE
6/14/2023	CADD Standards Update

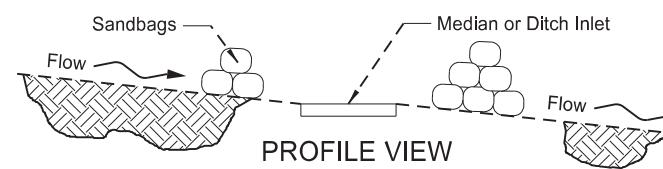
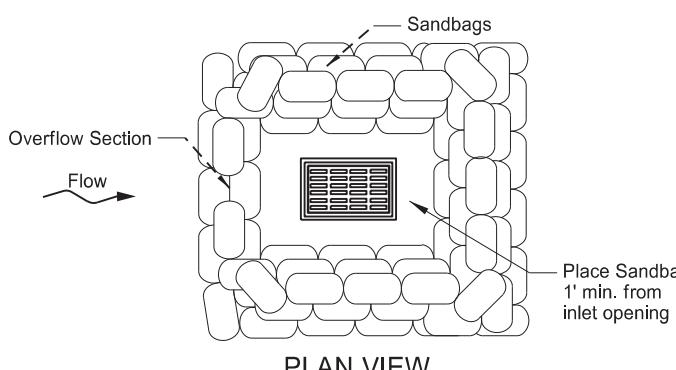
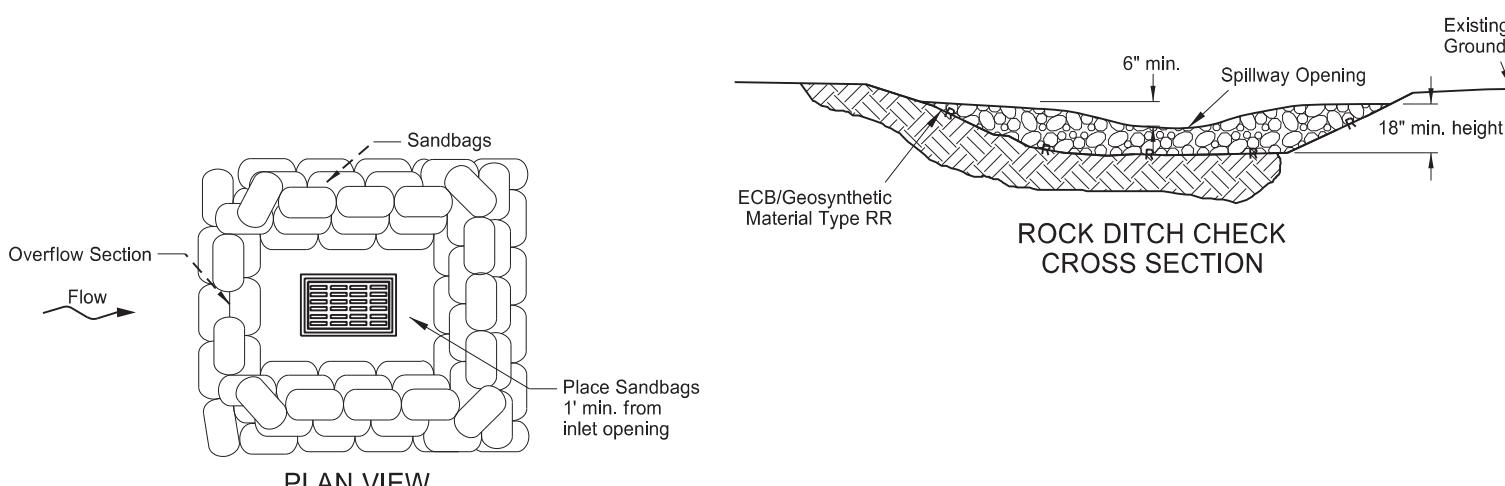
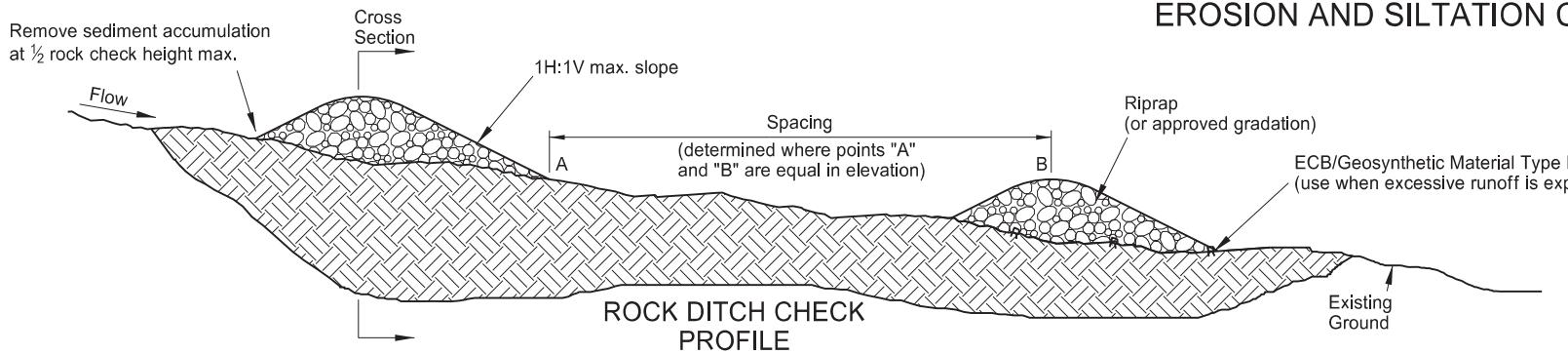


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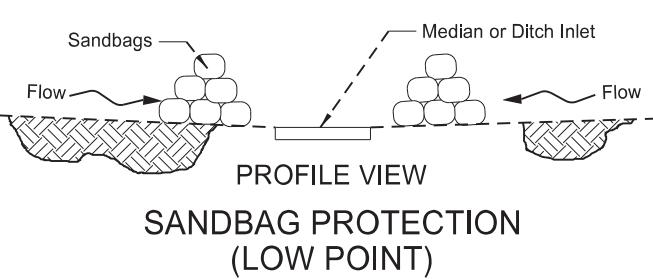
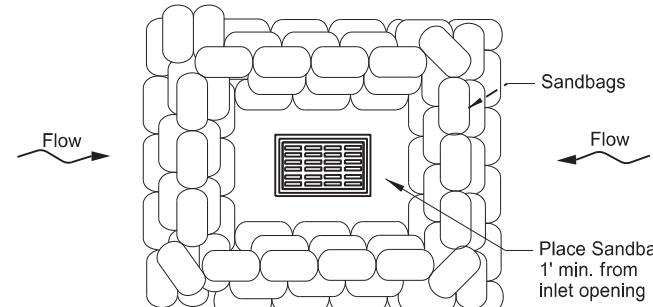
06/14/23

EROSION AND SILTATION CONTROLS

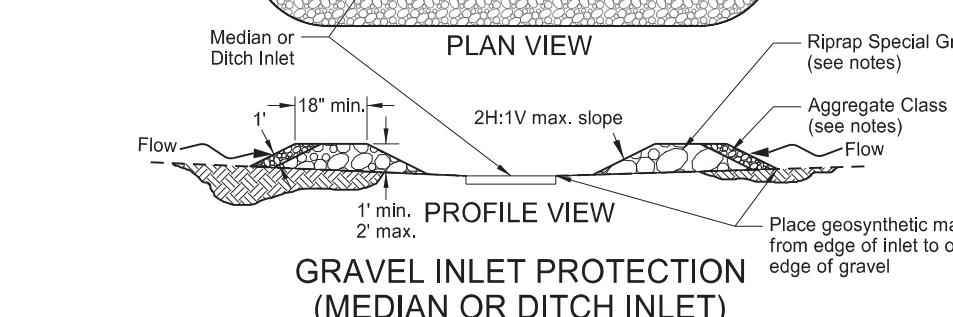
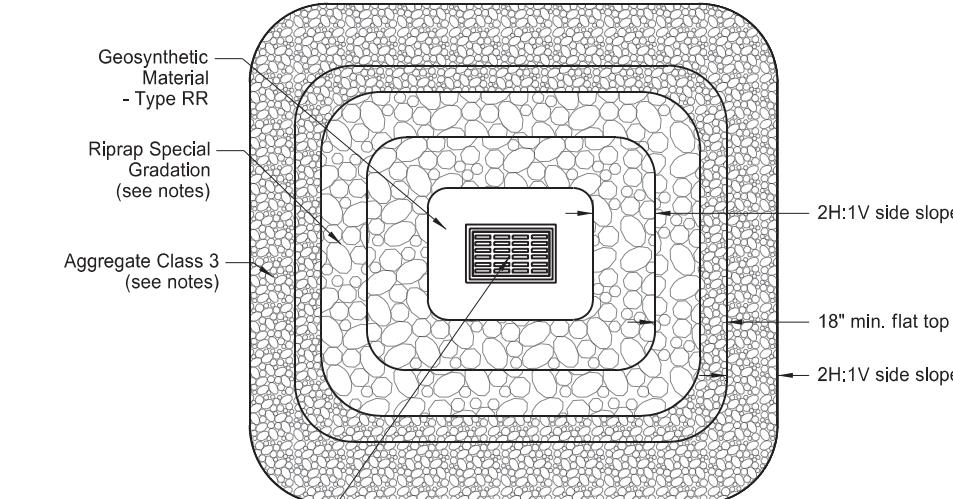
D-256-1



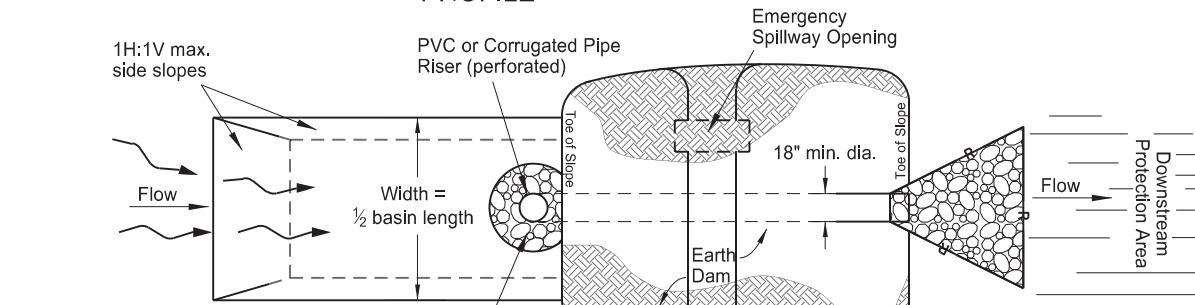
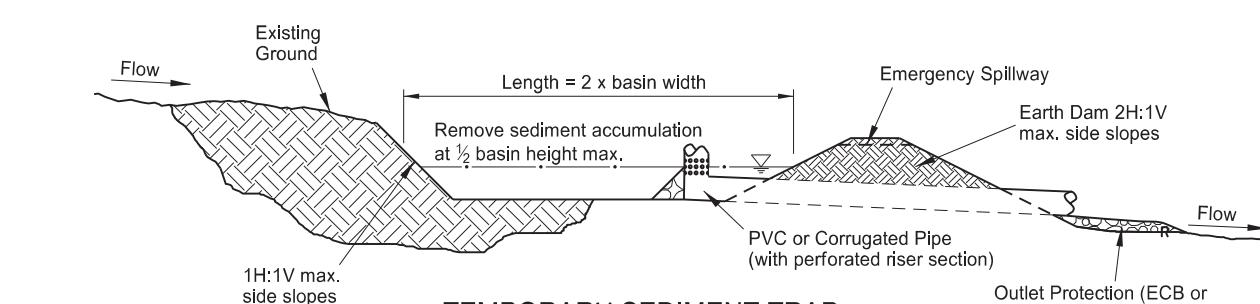
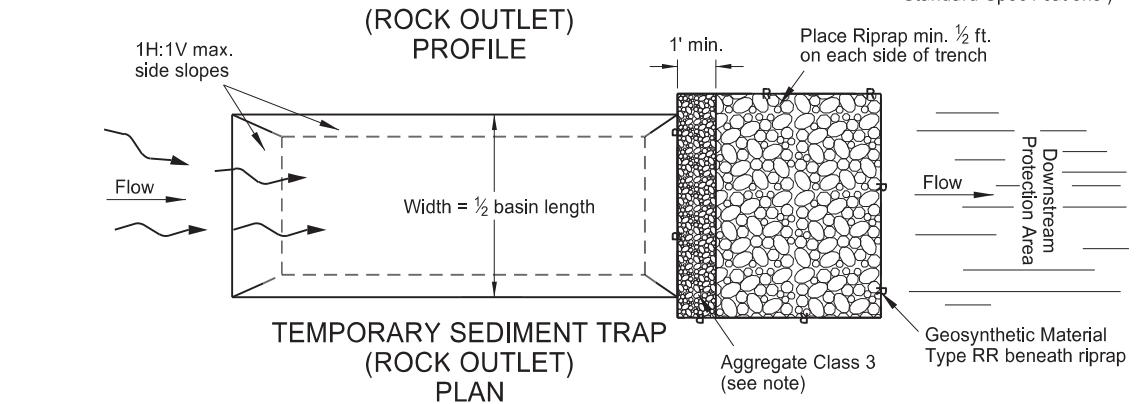
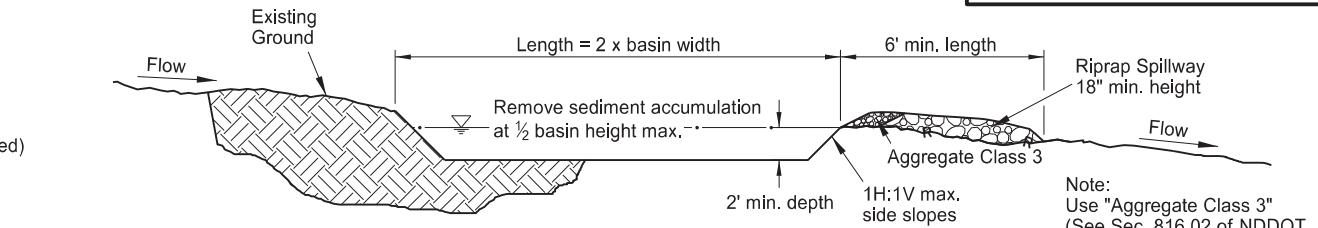
SANDBAG PROTECTION (ON SLOPE)



SANDBAG PROTECTION (LOW POINT)



Notes:
Use 2 in. to 15 in. diameter rock with 20% by weight exceeding 4 in. diameter for "Riprap Special Gradation."
"Aggregate Class 3" (See Sec. 816.02 of NDDOT Standard Specifications.)



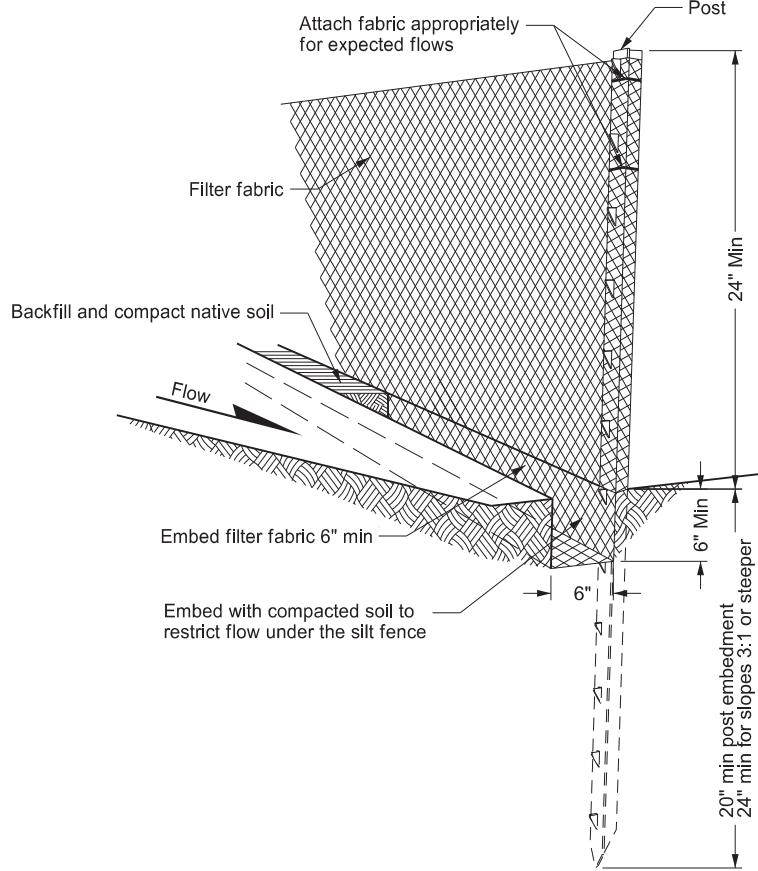
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-03-13	REVISIONS
DATE	
06-26-14	Changed standard drawing number from D-708-2 to D-256-1 Deleted silt fence details Updated to active vdo New Design Engineer PE Stamp Added Median Drain Protection
10-17-17	
08-27-19	
09-02-25	



09/02/25

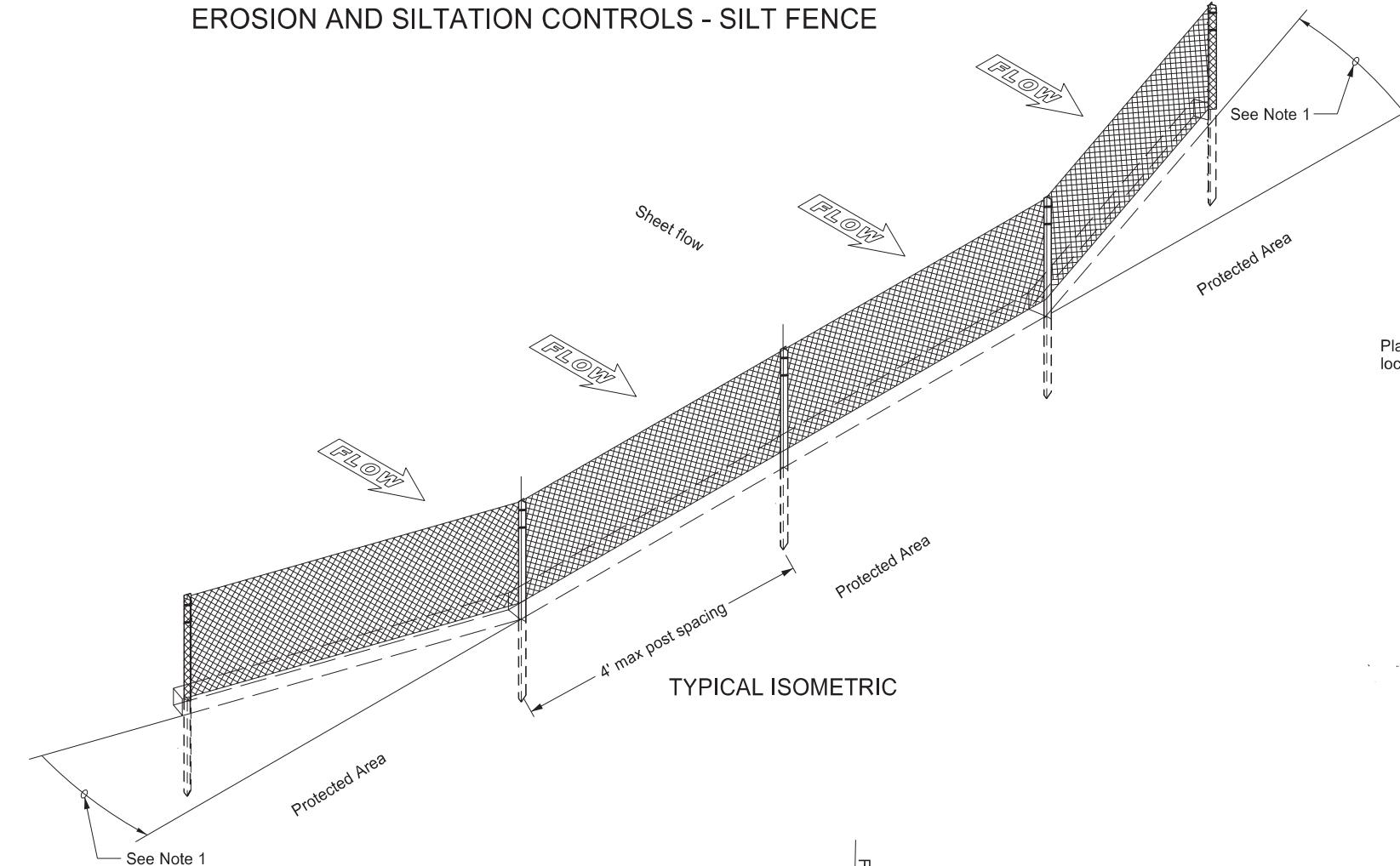
EROSION AND SILTATION CONTROLS - SILT FENCE

D-260-1

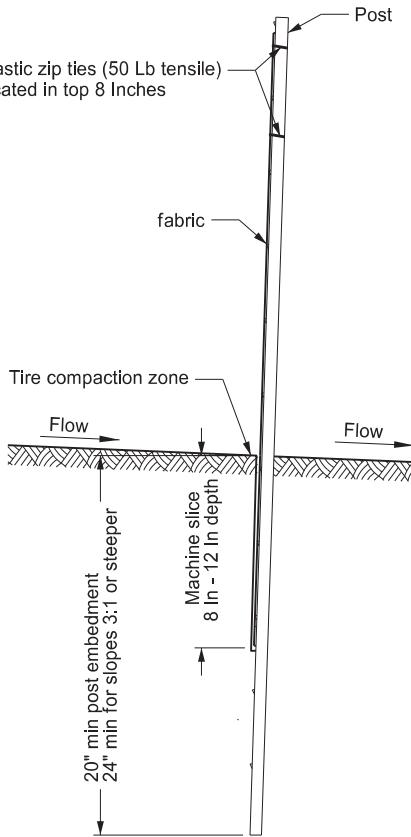


HAND PLACED INSTALLATION DETAIL

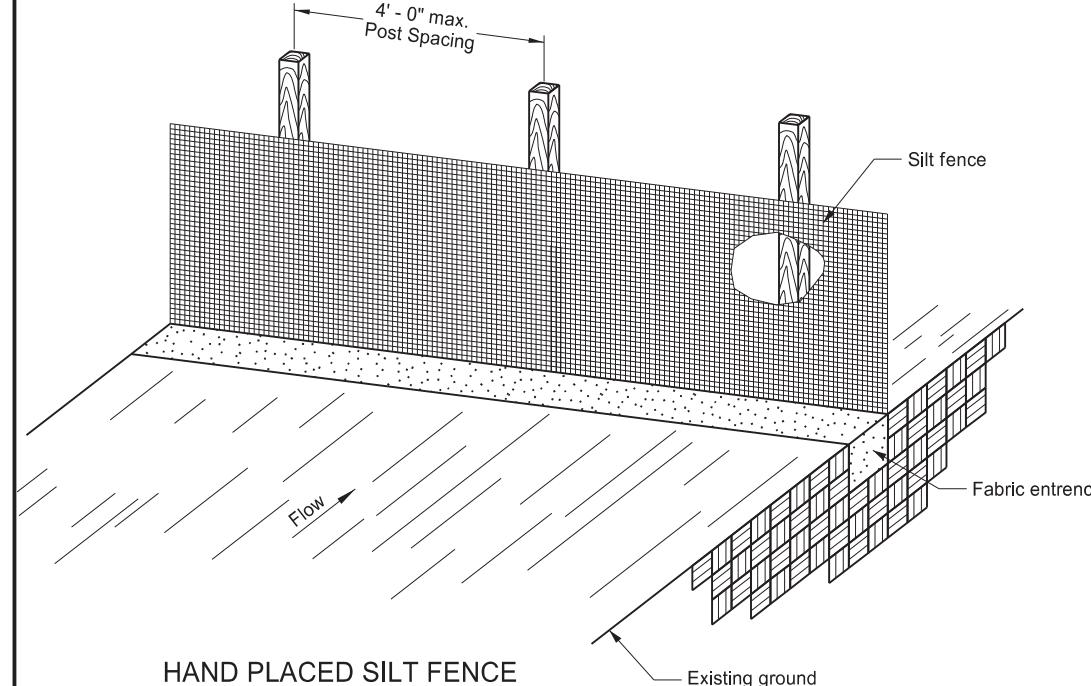
Minimize disturbance of ground around trench and smooth surface after excavation to avoid concentrating flows. Compact to prevent undercutting flows.



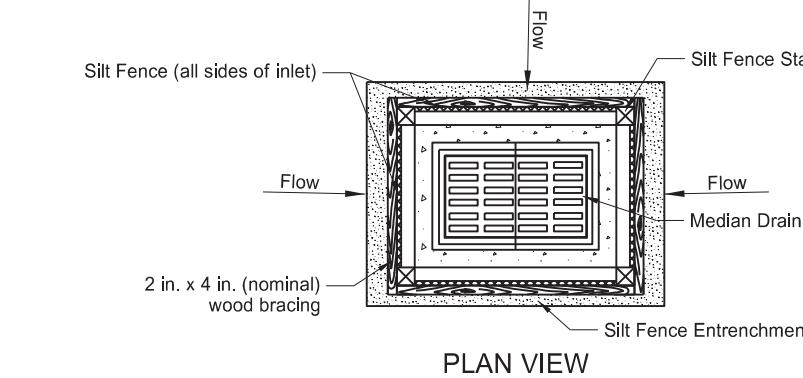
TYPICAL ISOMETRIC



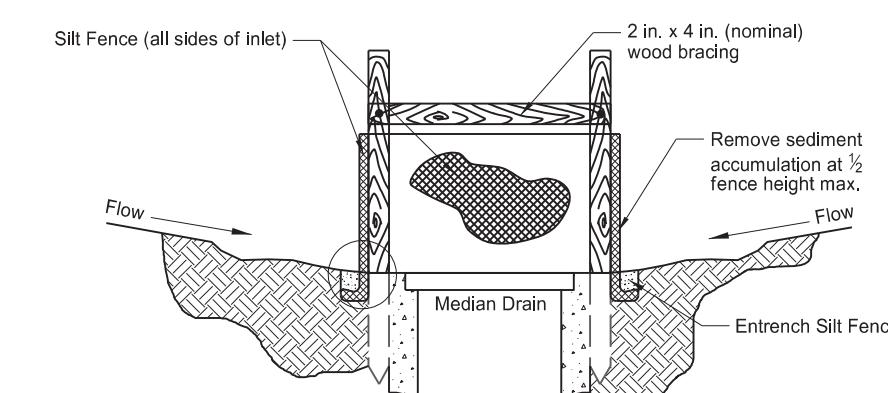
MACHINE SLICED INSTALLATION DETAIL



HAND PLACED SILT FENCE



PLAN VIEW



PROFILE VIEW

SILT FENCE PROTECTION
(MEDIAN OR DITCH INLET)

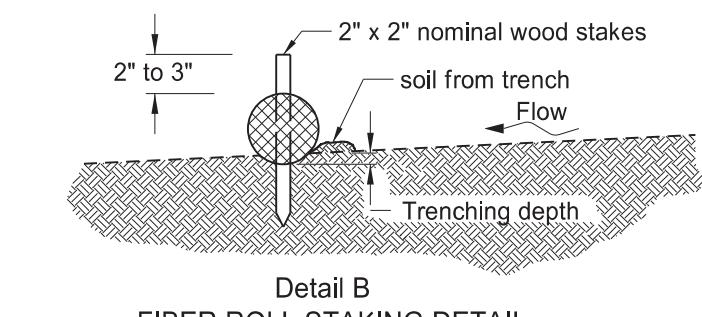
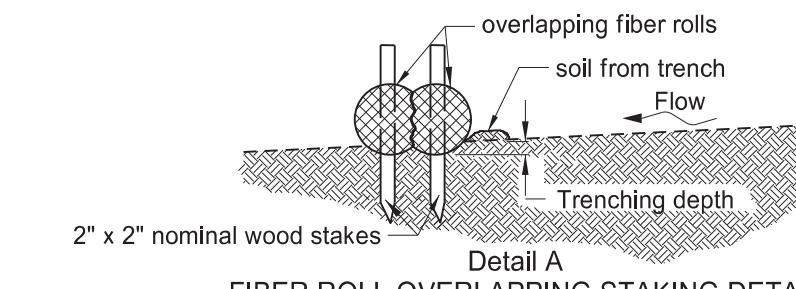
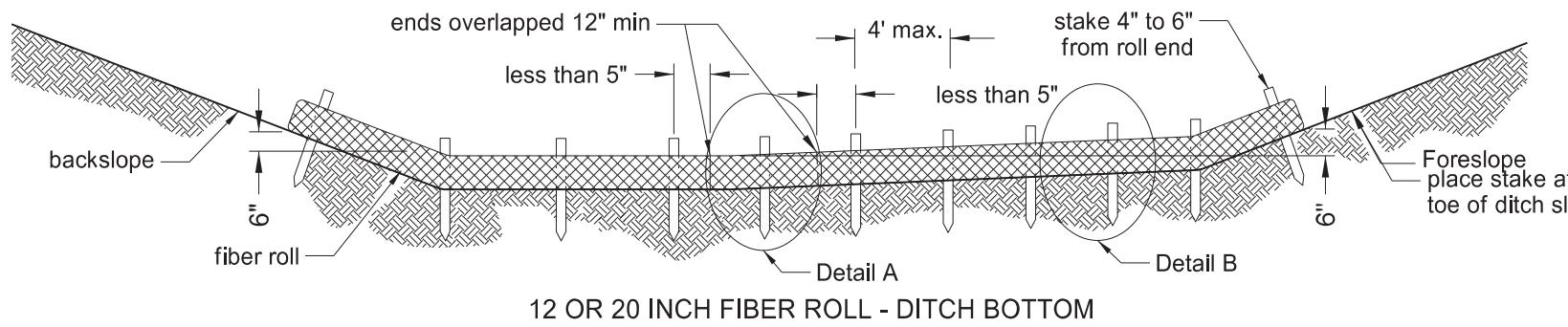
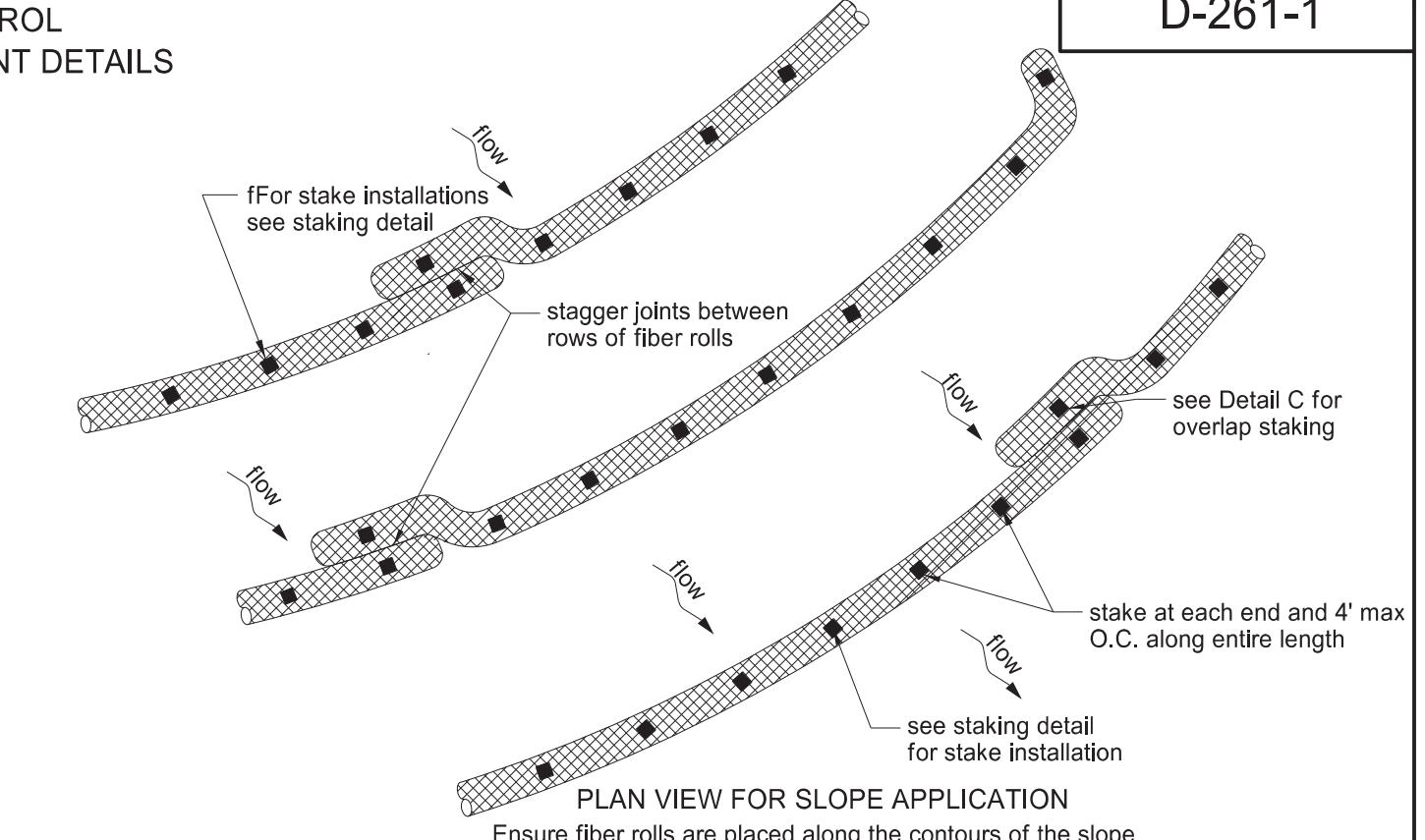
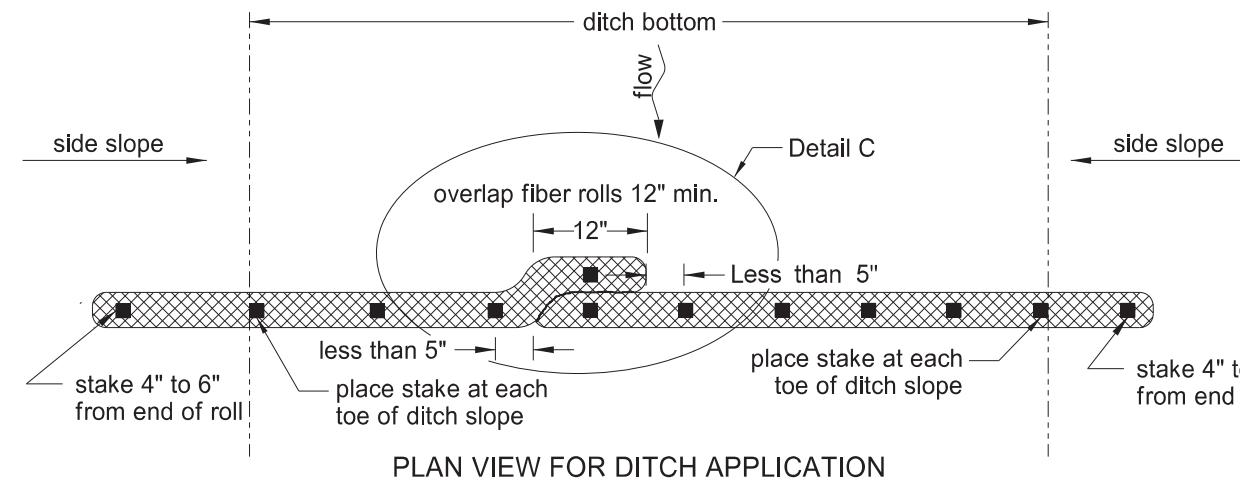
NOTES:
 1. Install the ends of the silt fence to point slightly upslope to prevent sediment from flowing around the ends of the fence.
 2. Place splices outside low spots.
 3. Do not embed silt fence placed in standing water.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-03-13	
REVISIONS	
DATE	CHANGE
06-26-14	Standard drawing resulted from splitting standard D-709-2
06-27-16	Revised details & added new ones
08-27-19	New Design Engineer PE Stamp
07-22-25	Matched revised silt fence specs
09-04-25	Added median-ditch inlet protection

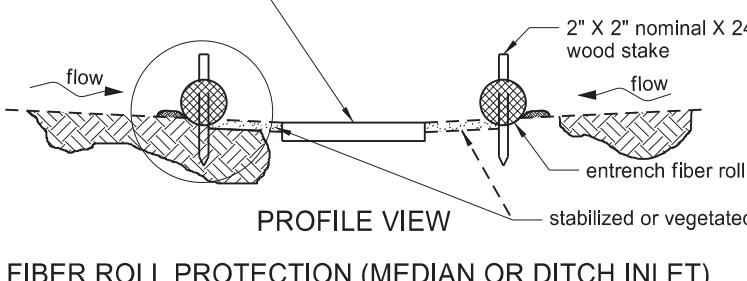
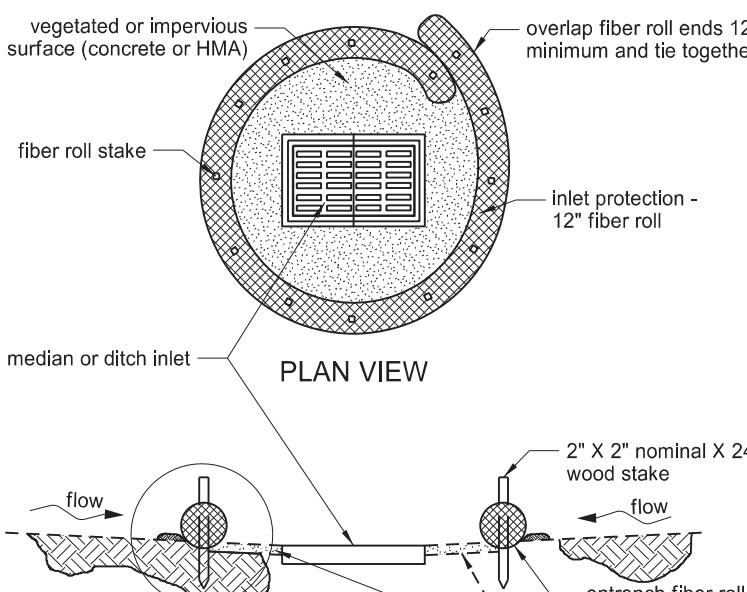


09/04/25

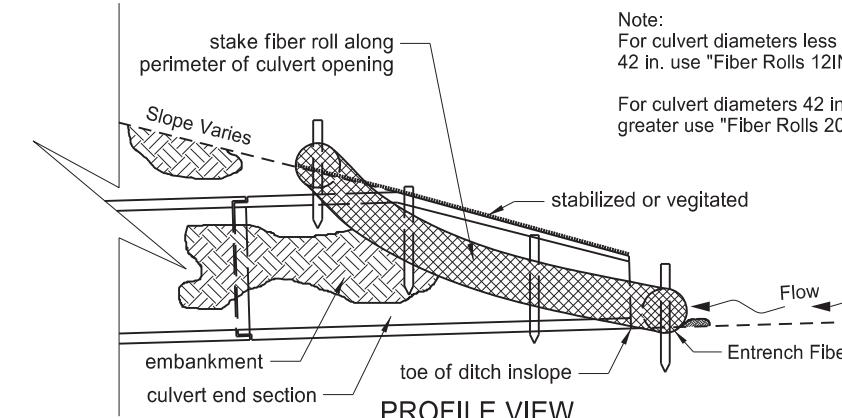
D-261-1

EROSION CONTROL
FIBER ROLL PLACEMENT DETAILS

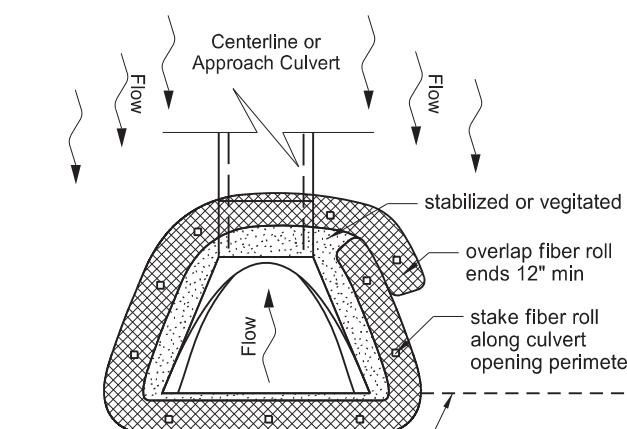
FIBER ROLL OVERLAPPING STAKING DETAIL



FIBER ROLL PROTECTION (MEDIAN OR DITCH INLET)



Note:
For culvert diameters less than 42 in. use "Fiber Rolls 12IN".
For culvert diameters 42 in. or greater use "Fiber Rolls 20IN".

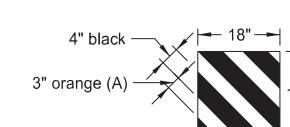
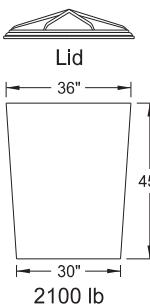


FIBER ROLL PROTECTION (INLET OF CULVERT)

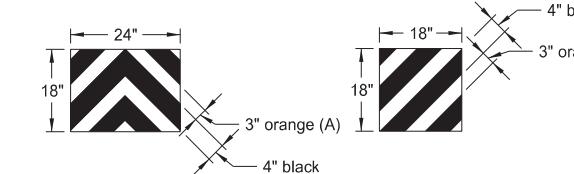
FIBER ROLL DIAMETER	NOMINAL STAKE SIZE	MINIMUM STAKE LENGTH	TRENCH DEPTH	
			MINIMUM	MAXIMUM
12"	2" x 2"	24"	2"	3"
20"	2" x 2"	36"	3"	5"
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION 11-18-10 REVISIONS DATE CHANGE 06-10-13 Added plan view for ditch and slope application. Added table with values for stake and trench dimensions. 10-04-13 Revised fiber roll overlap detail 06-26-14 Changed standard drawing number from D-708-7 to D-261-1 08-27-19 New Design Engineer PE Stamp 04-22-24 Slope Plan View-overlap change 03-13-25 Added D-708-6 Culvert Inlet detail 09-02-25 Added D-708-6 Inlet detail				
KIRK J. HOFF REGISTERED PROFESSIONAL PE-4683 ENGINEER NORTH DAKOTA 09/02/25				

ATTENUATION DEVICE

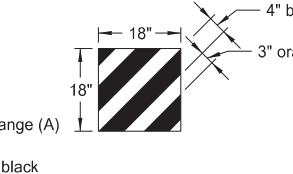
D-704-1



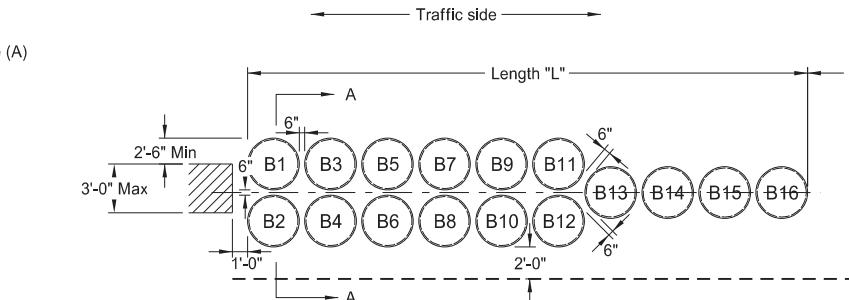
Left Side Traffic



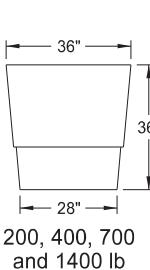
Both Sides Traffic



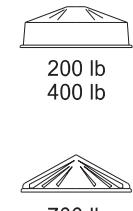
Right Side Traffic



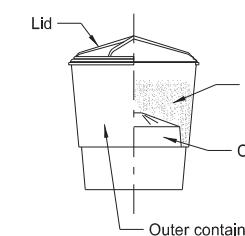
Type B Layout



Outer Containers



Cones



Typical Assembly

Typical Module Construction Detail

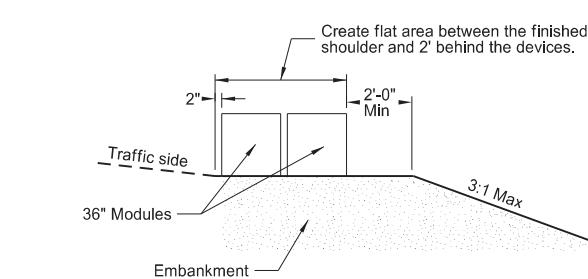
Reflective Sheet Detail

Note:
Apply Type IV reflective sheeting (as specified in the NDDOT Standard Specifications) directly to the outer container of the last attenuation device facing traffic, following the details above. Or apply the sheet to a metallic sheet and attach it to the container with approved fasteners.

(A) Use 3" orange sheeting for temporary installations, and 3" yellow sheeting for permanent installations.

	Module Weights (LBS)				
	200	400	700	1400	2100
Distance from top edge	8½"	5"	4"	3"	0"

Note:
Angle attenuation devices 10 degrees towards traffic when placed at piers offset from roadway.

Section A-A
(Type B Layout)

Type B Attenuation Device											
Module Number	Dash Number										
	80	75	70	65	60	55	50	45	40	35	30
Module Weights (LBS)											
B1	2100	2100									
B2	2100	2100									
B3	2100	2100	2100	2100	2100	2100	2100	2100	2100		
B4	2100	2100	2100	2100	2100	2100	2100	2100	2100		
B5	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
B6	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
B7	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
B8	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
B9	700	700	700	700	700	700	700	700	700	700	700
B10	700	700	700	700	700	700	700	700	700	700	700
B11	700	700	700	700	700	700	700	700	700	700	700
B12	700	700	700	700	700	700	700	700	700	700	700
B13	700	700	700	700	700	700	700	700	700	700	700
B14	400	400	400	400	400	400	400	400	400	400	400
B15	400	400	400	400	400	400	400	400	400	400	400
B16	200	200	200	200	200	200	200	200	200	200	200
Length (L)	34.2'	34.2'	30.7'	30.7'	30.7'	30.7'	30.7'	30.7'	30.7'	27.2'	27.2'
Module Weights (LBS)	Replacement Module										
2100	1	1	1	1	1	1	1	1	1		
1400	1	1	1	1	1	1	1	1	1	1	1
700	2	2	2	2	2	2	2	2	2	2	2
400	1	1	1	1	1	1	1	1	1	1	1
200	2	2	2	2	1	1	1	1	1	1	1

Notes:

- Materials
 - Use modules manufactured from frangible polyethylene material which shatters upon impact.
 - Fill modules with class 43 aggregate meeting NDDOT Standard Specifications aggregate requirements. Use fill with a unit weight of at least 100 pounds per cubic foot. Use fill with a moisture content of 2% or less when left over winter.
- Modules
 - Provide modules in two sizes containing volumes of either 2, 4, 7, 14, or 21 cubic feet minimum.
 - Provide three components for 2, 4, or 7 cubic foot module containers:
 - 14 C.F. yellow outer container.
 - Black lid securely locking over the top lip of the container.
 - A variable cone-shaped supporting insert capable of supporting 200, 400, or 700 pounds of sand mass to allow for three sizes of modules. Place cone inserts inside the 14 cubic foot container.
 - Provide two components for the 14 cubic foot module container:
 - 14 C.F. yellow outer container.
 - Black lid securely locking over the top lip of the container.
 - Provide two components for the 21 cubic foot module container:
 - 36" height X 36" width yellow outer container.
 - Black lid which locks securely over the top of the container.
- For temporary installations use Energiere or Fitch attenuation barrels manufactured by Energy Absorption Systems of Chicago, IL, TrafFix barrels manufactured by TrafFix Devices, Inc. of San Clemente, CA, or approved equal modules. As an option, place attenuation devices on 3½" maximum thickness pallets to facilitate maintenance.
- For permanent installations use Barrel Attenuation Device consisting of one-piece outer sand container modules with separate detachable lid. Energiere attenuation barrels manufactured by Energy Absorption Systems of Chicago, IL, TrafFix barrels manufactured by TrafFix Devices, Inc. of San Clemente, CA, or approved equal meet these requirements.
- The Typical Module Construction Detail and Type B Layout are based on the Energiere Crash Cushion manufactured by Energy Absorption. Provide any required layouts and details from other sand filled attenuation module manufacturers which differ from those shown here.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-25-12	
REVISIONS	
DATE	CHANGE
07-18-14	Revised sheeting in reflective sheet detail
09-27-17	Update to active voice
10-03-19	New Design Engr PE Stamp
08-01-24	Electronic Stamp/Signature
06-30-25	Legislative Changes



BREAKAWAY SYSTEMS FOR CONSTRUCTION ZONE SIGNS

D-704-7

Perforated Tube

Multi-Directional Slip Base Assembly

Top Post Receiver
Plate - ASTM A572 grade 50
Angle Receiver - $2\frac{1}{2}'' \times 2\frac{1}{2}'' \times 3\frac{3}{8}''$ ASTM A36 structural angle

Bottom Soil Stub
Tube - $3'' \times 3'' \times 7$ gauge ASTM A500 grade B tube
Stabilizing Wing - 7 gauge H.R.P.O. ASTM A1011
Plate - ASTM A572 grade 50

Anchor Unit and Post Assembly

Multi-Directional Slip Base Anchor Unit and Post Sleeve Assembly

Bolt Retainer for Base Connection
Bolt Retainer- $\frac{1}{32}''$ Reprocessed Teflon

Notes:

1. Torque slip base bolts as specified by manufacturer.
2. Use anchor with 43.9 KSI yield strength and 59.3 KSI tensile strength.
3. Provide 4" vertical clearance for anchor or breakaway base. Measure the 4"x60" measurement above and below post location and back and ahead of post.
4. In concrete sidewalk, use same anchor without wings.
5. Provide more than 7' between the first and fourth posts of a four post sign.

Telescoping Perforated Tube

Number of Posts	Post Size in.	Wall Thickness Gauge	Sleeve Size in.	Wall Thickness Gauge	Anchor Size without Slip Base in.
1	2	12			No $2\frac{1}{4}$
1	$2\frac{1}{2}$	12			No $2\frac{1}{2}$
1	$2\frac{1}{2}$	12			(A) 3
1	$2\frac{1}{2}$	10			Yes
1	$2\frac{1}{4}$	12	2	12	Yes
1	$2\frac{1}{2}$	12	$2\frac{1}{4}$	12	Yes
2	2	12			No $2\frac{1}{4}$
2	$2\frac{1}{4}$	12			No $2\frac{1}{2}$
2	$2\frac{1}{2}$	12			Yes
2	$2\frac{1}{4}$	10	2	12	Yes
2	$2\frac{1}{2}$	12	$2\frac{1}{4}$	12	Yes
3 & 4	$2\frac{1}{2}$	12			Yes
3 & 4	$2\frac{1}{2}$	10			Yes
3 & 4	$2\frac{1}{2}$	12	$2\frac{1}{4}$	12	Yes
3 & 4	$2\frac{1}{4}$	12	2	12	Yes
3 & 4	$2\frac{1}{2}$	10	$2\frac{1}{4}$	10	Yes

Properties of Telescoping Perforated Tube

Tube Size in.	Wall Thickness in.	U.S. Standard Gauge	Weight per Foot lbs.	Moment of Inertia in. ⁴	Cross Sec. Area in. ²	Section Modulus in. ³
$1\frac{1}{2} \times 1\frac{1}{2}$	0.105	12	1.702	0.129	0.380	0.172
2 x 2	0.105	12	2.416	0.372	0.590	0.372
$2\frac{1}{4} \times 2\frac{1}{4}$	0.105	12	2.773	0.561	0.695	0.499
$2\frac{3}{16} \times 2\frac{3}{16}$	0.135	10	3.432	0.605	0.841	0.590
$2\frac{1}{2} \times 2\frac{1}{2}$	0.105	12	3.141	0.804	0.803	0.643
$2\frac{1}{2} \times 2\frac{1}{2}$	0.135	10	4.006	0.979	1.010	0.785

Top Post Receiver Data Table

Square Post Sizes (B)	A	B	C	D	E	F
$2\frac{3}{16}'' \times 10$ ga.	$1\frac{1}{64}''$	$2\frac{1}{2}''$	$3\frac{1}{32}''$	$2\frac{5}{32}''$	$1\frac{33}{64}''$	$1\frac{7}{8}''$
$2\frac{1}{2}'' \times 10$ ga.	$1\frac{1}{32}''$	$2\frac{1}{2}''$	$3\frac{5}{16}''$	$\frac{5}{8}''$	$1\frac{21}{32}''$	$1\frac{3}{4}''$

(A) Use breakaway base when support is placed in weak soils. Engineer determines if soils are weak.

(B) For additional wind load, insert the $2\frac{3}{16}'' \times 10$ ga. into $2\frac{1}{2}'' \times 10$ ga.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
2-28-14
REVISIONS

DATE	CHANGE
9-27-17 10-03-19 8-01-24	Updated to active voice New Design Engr PE Stamp Electronic Stamp/Signature

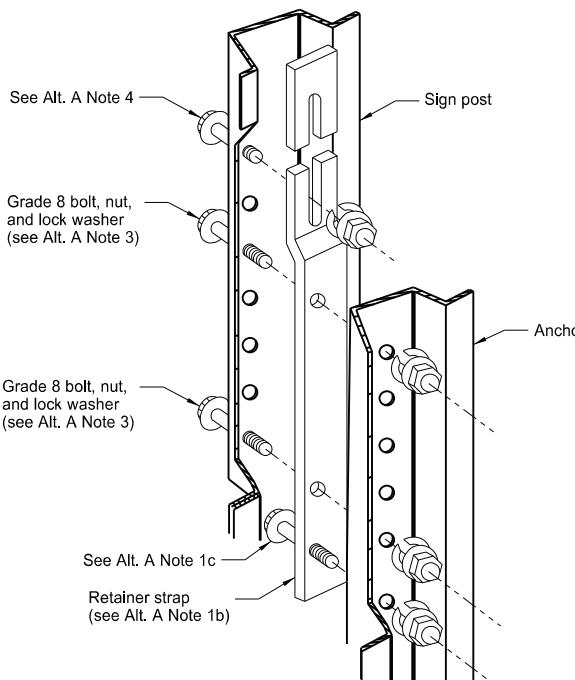
KIRK J. HOFF
REGISTERED
PROFESSIONAL
PE-4683
ENGINEER
NORTH DAKOTA

08/01/24

BREAKAWAY SYSTEMS FOR CONSTRUCTION ZONE SIGNS

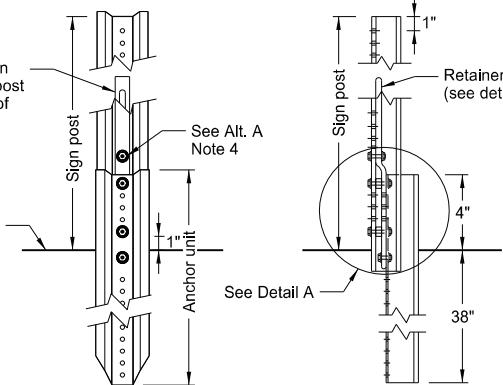
D-704-8

U-Channel Post

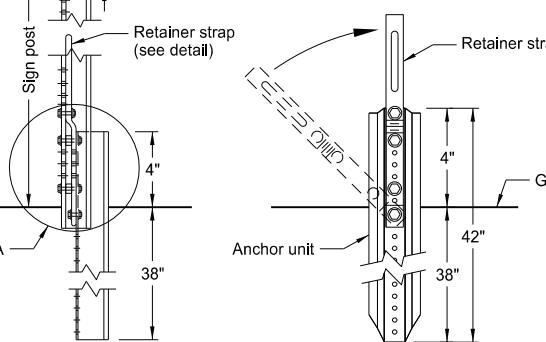


Detail A

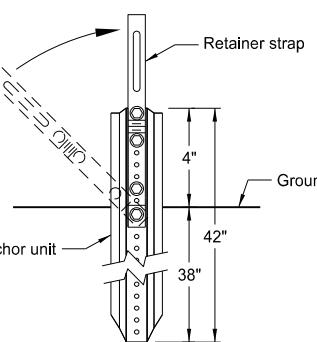
Retainer strap is on front side of sign post and on back side of anchor unit



Front View



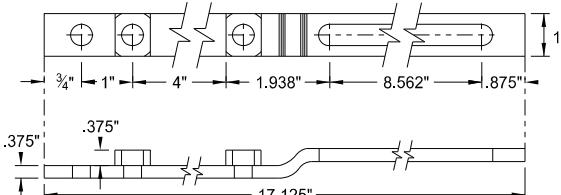
Side View



Back View

Breakaway U-Channel Detail Alternate A

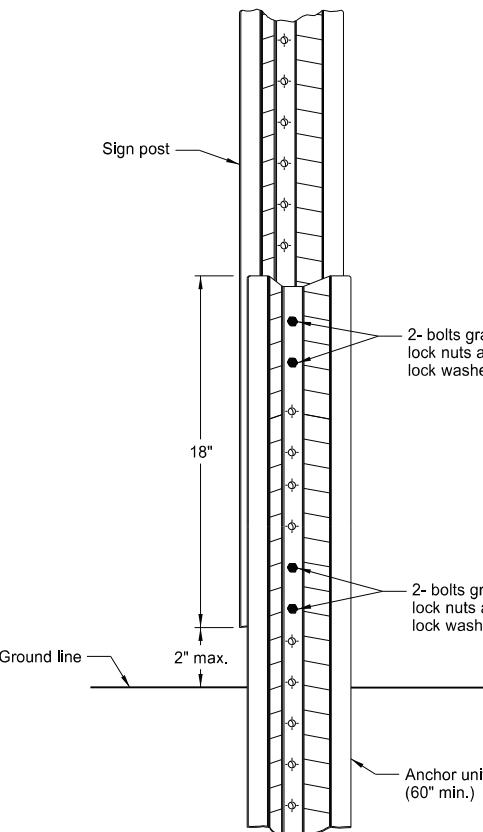
Install a maximum of 2 posts within 7'.



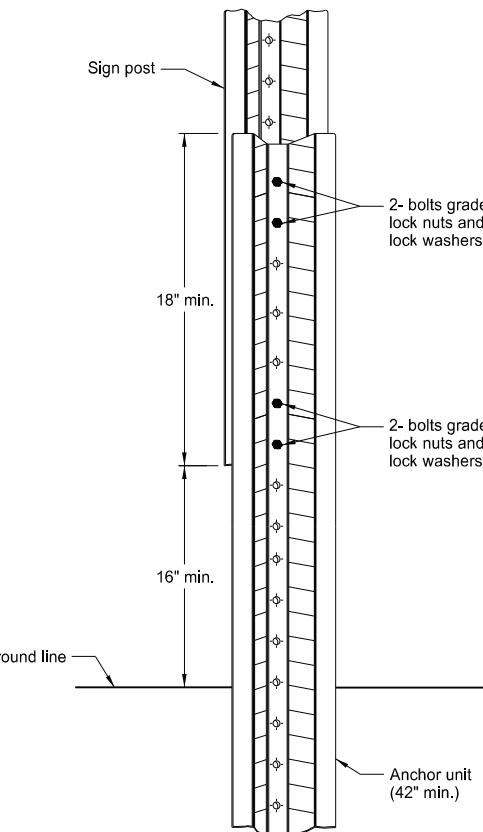
Retainer Strap Detail

Alternate A Steps of Installation:

- a) Drive anchor unit to within 12" of ground level.
b) Establish proper assembly by lining up bottom hole of retainer strap with 6th hole from the top of the anchor unit.
c) Assemble strap to back of anchor unit using $\frac{5}{16}$ "x2" bolt, lock washer and nut.
d) Rotate strap 90° to left.
- a) Drive anchor unit to 4" above ground.
b) Rotate strap to vertical position.
- a) Place $\frac{5}{16}$ "x2" bolt, lock washer and nut in bottom of sign post to facilitate alignment of sign post with proper hole in anchor unit.
b) Alternately tighten two connector bolts.
- Complete assembly by tightening $\frac{5}{16}$ "x2" bolt (this fastens sign post to retainer strap).
- Properly nest base post, strap, and sign post. Proper nesting occurs when all flat surfaces of the base post, strap, and sign post at the bolts have full contact across the entire width.

Breakaway U-Channel Splice Detail
Alternate B
(2.5 and 3 lb/ft)

Install a maximum of 3 posts within 7'.

Breakaway U-Channel Splice Detail
Alternate C
(2.5 and 3 lb/ft)

Install a maximum of 3 posts within 7'.

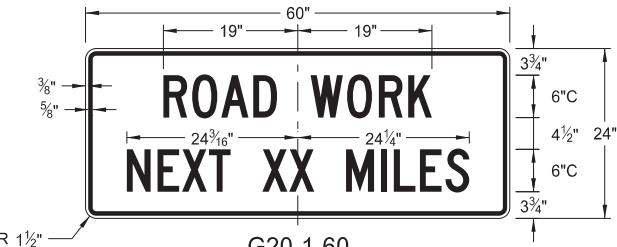
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
2-28-14	
REVISIONS	
DATE	CHANGE
9-27-17 10-03-19 8-01-24	Updated to active voice New Design Engr PE Stamp Electronic Stamp/Signature



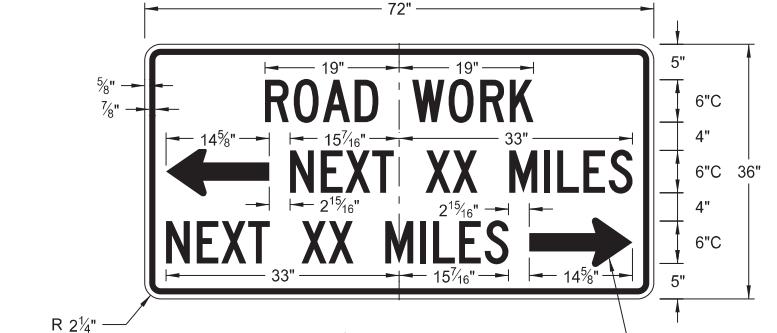
08/01/24

CONSTRUCTION SIGN DETAILS
TERMINAL AND GUIDE SIGNS

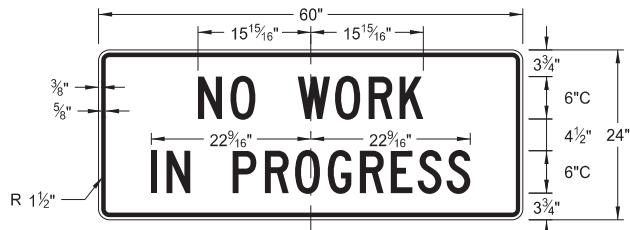
D-704-9



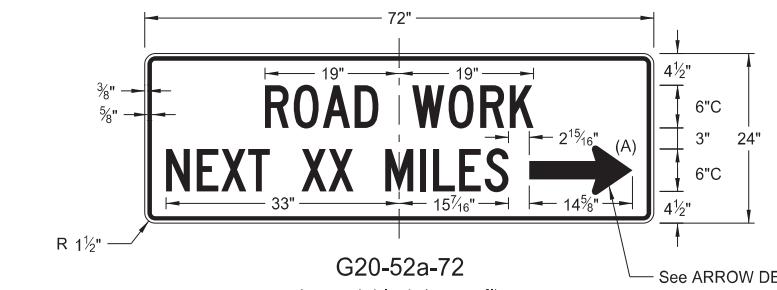
G20-1-60

Legend: black (non-refl)
Background: orange

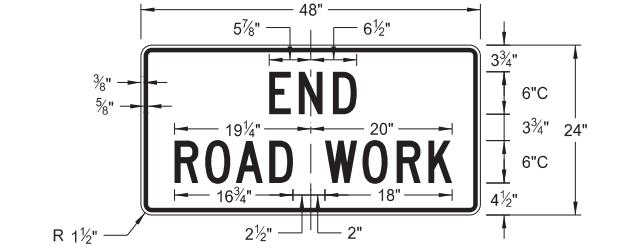
G20-50a-72

Legend: black (non-refl)
Background: orange

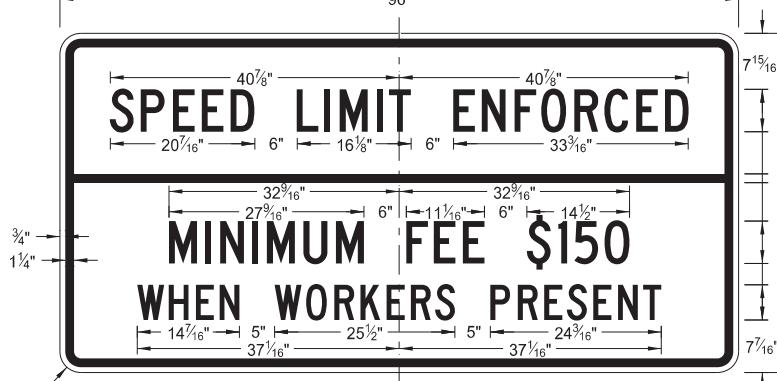
G20-1b-60

Legend: black (non-refl)
Background: orange

G20-52a-72

Legend: black (non-refl)
Background: orange

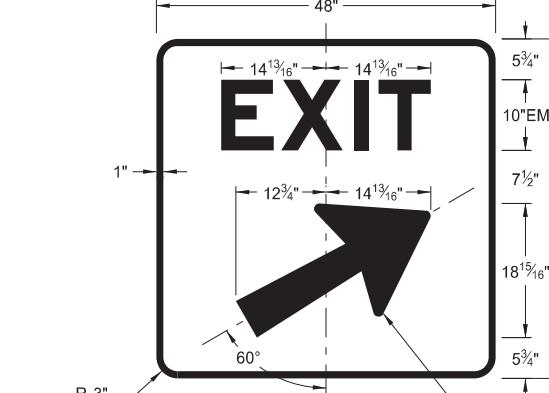
G20-2-48

Legend: black (non-refl)
Background: orange

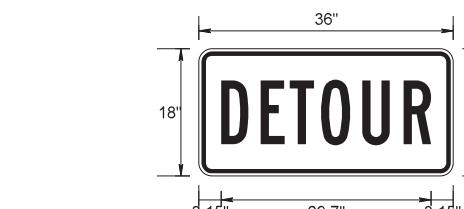
G20-55-96

Legend: black (non-refl)
Background: orange

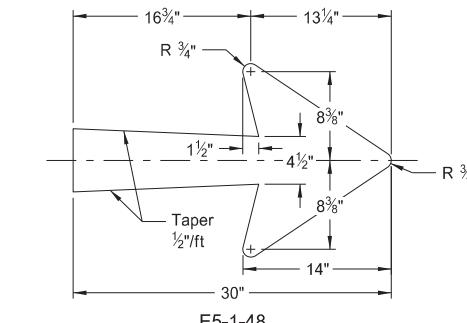
G20-4b-36

Legend: black (non-refl)
Background: orange

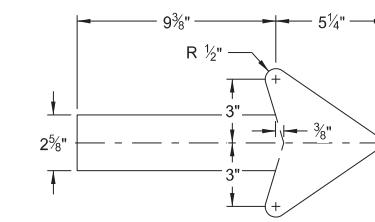
E5-1(L or R)-48

Legend: white
Background: green (orange optional)

M4-8-36

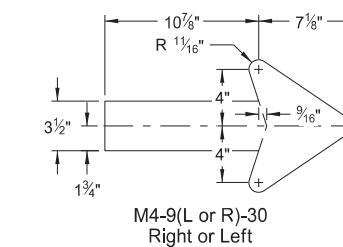
Legend: black (non-refl)
Background: orange

E5-1-48



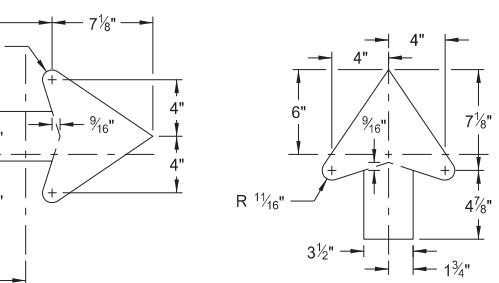
G20-50a-72

G20-52a-72



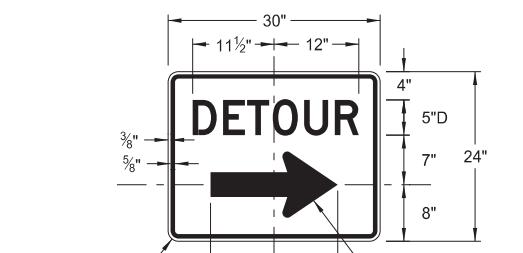
M4-9(L or R)-30

Right or Left

M4-9(L or R)-30
Advanced Right or Left

M4-9-30

Straight

M4-9(L or R)-30 &
M4-9-30Legend: black (non-refl)
Background: orange

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE
08-17-17 10-03-19 08-01-24 06-30-25	Added sign & background color New Design Engineer PE Stamp Electronic Stamp/Signature Legislative Changes



KIRK J. HOFF
REGISTERED
PROFESSIONAL
PE-4683
06/30/25
ENGINEER
NORTH DAKOTA

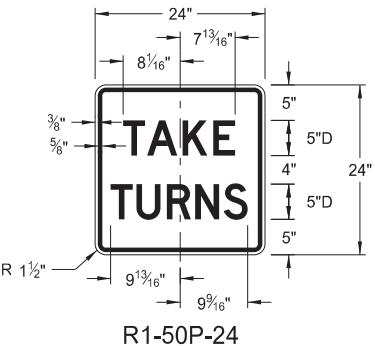
NOTES:

(A) Arrow may be right or left of the legend to indicate construction to the right or left.

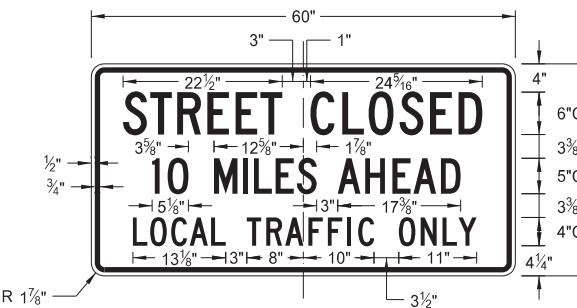
ARROW DETAILS

CONSTRUCTION SIGN DETAILS
REGULATORY SIGNS

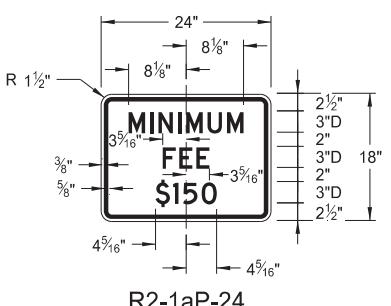
D-704-10



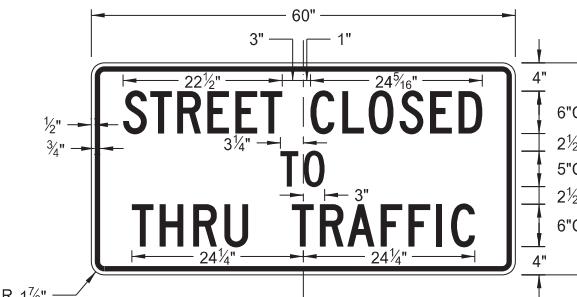
R1-50P-24

Legend: black (non-refl)
Background: white

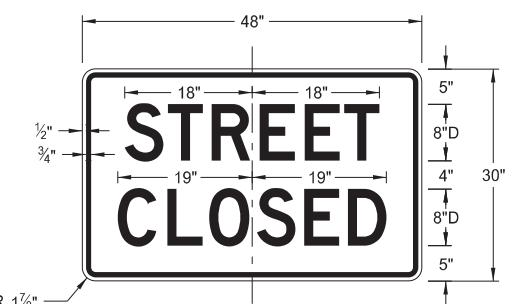
R11-3c-60

Legend: black (non-refl)
Background: white

R2-1aP-24

Legend: black (non-refl)
Background: white

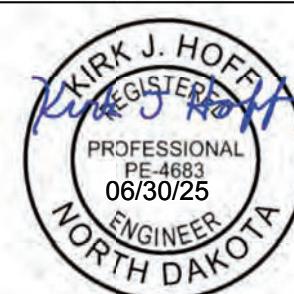
R11-4a-60

Legend: black (non-refl)
Background: white

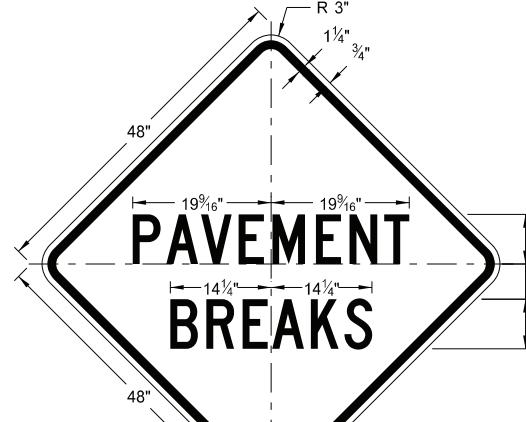
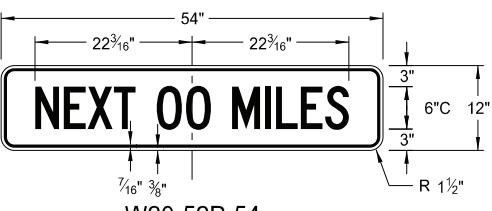
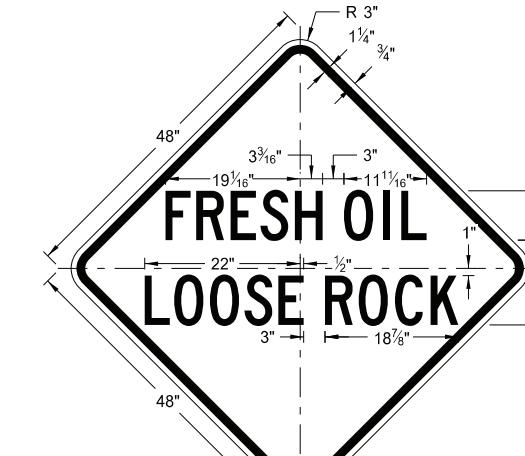
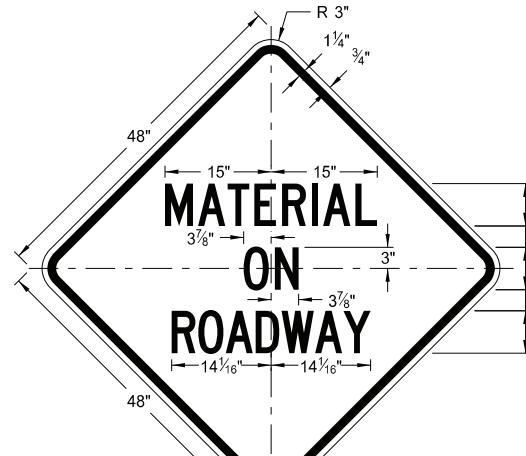
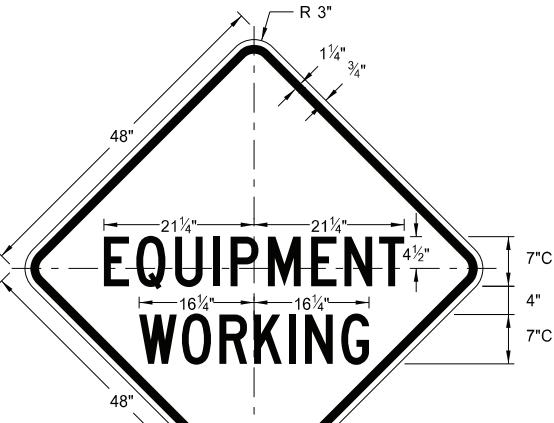
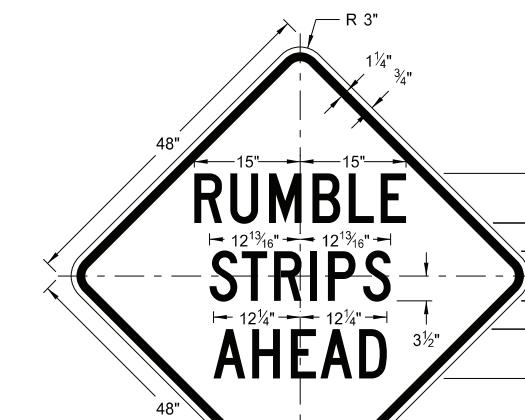
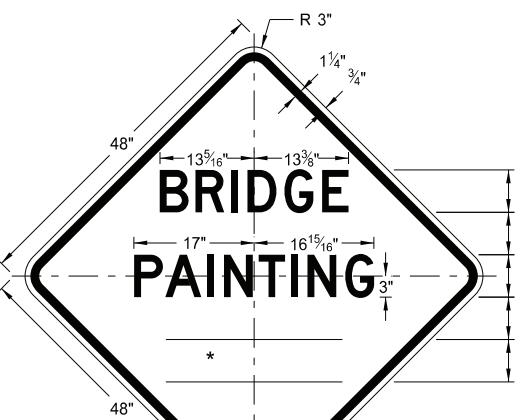
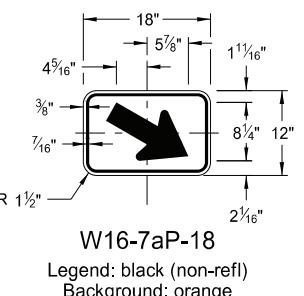
R11-2a-48

Legend: black (non-refl)
Background: white

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE
08-17-17 10-03-19 08-01-24 06-30-25	Revised sign number New Design Engineer PE Stamp Electronic Stamp/Signature Legislative Changes

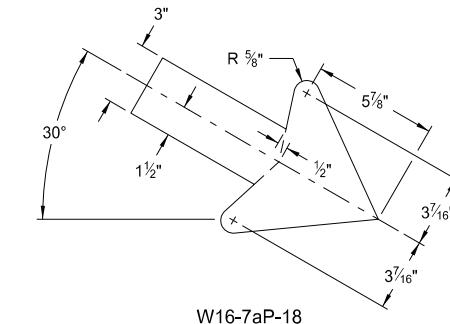


D-704-11A

CONSTRUCTION SIGN DETAILS
WARNING SIGNS

WORD	LETTER SPACING
AHEAD	Standard
200 FT	Standard
350 FT	Standard
500 FT	Standard
1000 FT	Reduce 40%
1500 FT	Reduce 40%
½ MILE	Reduce 50%
1 MILE	Standard

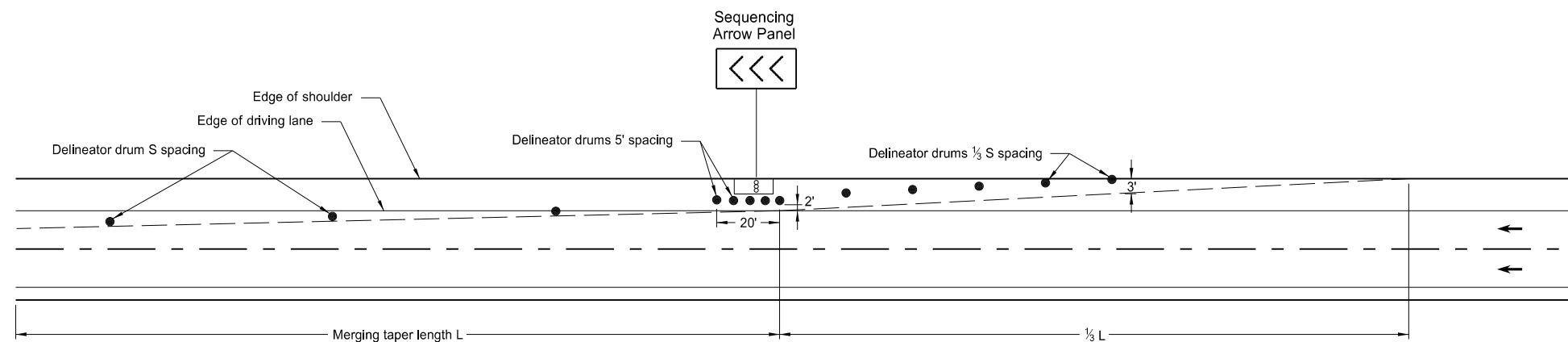
* DISTANCE MESSAGES



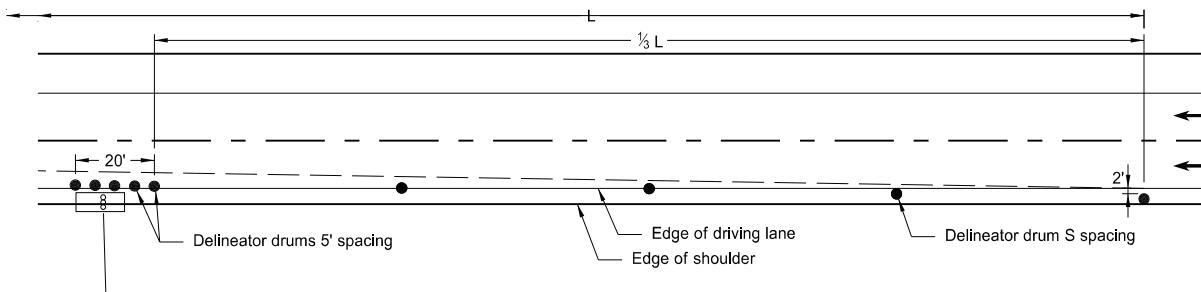
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
5-31-18	
REVISIONS	
DATE	CHANGE
11-01-19 8-01-24	Added details for sign W16-7aP-18. Electronic Stamp/Signature.
KIRK J. HOFF REGISTERED PROFESSIONAL PE-4683 ENGINEER NORTH DAKOTA 08/01/24	

SHOULDER CLOSURE TAPERS

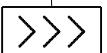
D-704-12



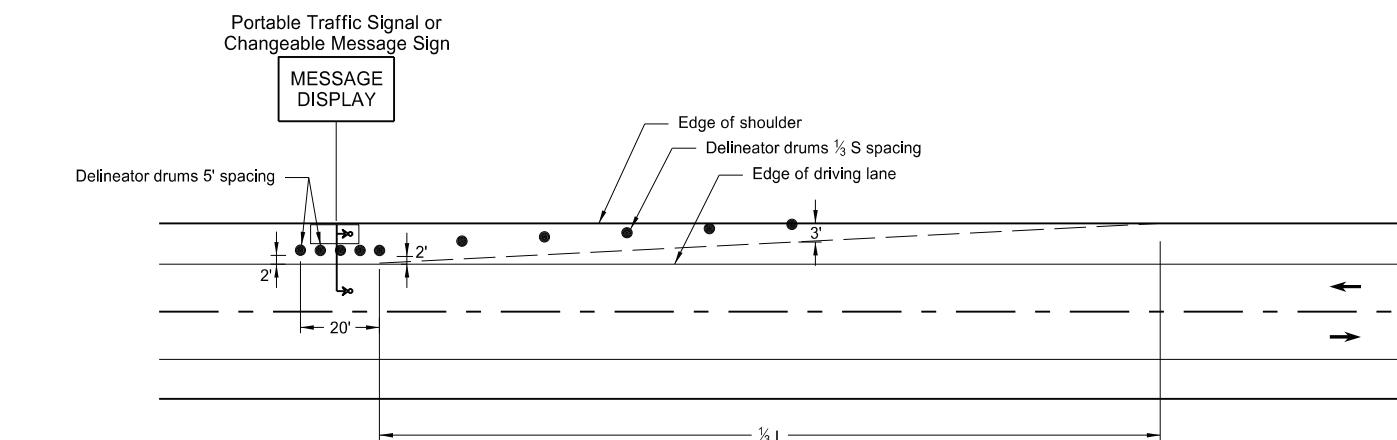
SHOULDER CLOSURE WITH LANE CLOSURE
(when shoulder is 8' or wider)



SHOULDER CLOSURE USED WITH LANE CLOSURE
(when shoulder is less than 8' wide)



Sequencing Arrow Panel



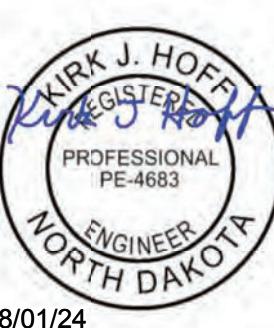
PORTABLE TRAFFIC SIGNAL OR CHANGEABLE MESSAGE SIGN ON SHOULDER

Notes:

1. S = Posted Speed Limit in mph
 W = Width of offset in feet
 L = Taper length in feet
 $L = WS^2/60$ (40mph or less)
 $L = WS$ (45mph or more)
2. If a shoulder taper is used, use a length of approximately $\frac{1}{3}L$. If a shoulder is used as a travel lane, use a normal merging or shifting taper.
3. When paved shoulders of 8 foot width or more are closed, use channelizing devices to close shoulder in advance, to delineate beginning of work space, and to direct vehicular traffic to remain within the traveled way.

KEY	
● Delineator Drum	∞ Sequencing Arrow Panel
• Message Display	↳ Portable Traffic Signal

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-13	
REVISIONS	
DATE	CHANGE
9-27-17 10-25-19 8-01-24	Updated to active voice Added L dimension to detail Electronic Stamp/Signature



08/01/24

BARRICADE AND CHANNELIZING DEVICE DETAILS

D-704-13

DELINERATOR DRUM

Provide horizontal, circumferential, alternating orange and white retroreflective stripes 4" to 6" wide for drum markings. Use a minimum of two orange and two white stripes with the top stripe being orange for each drum. Do not exceed 3" nonretroreflective spaces between the horizontal orange and white stripes. Avoid placement of stripes on drum ribs or indentations. Use closed top drums that will not allow collection of debris. Do not place ballast on the top of drum.

VERTICAL PANEL

Provide alternating orange and white retroreflective stripes, sloping downward in direction vehicular traffic is to pass. Place retroreflective sheeting on both sides of panel with a minimum of 270 square inches of retroreflective area facing vehicular traffic. Where the height of the retroreflective material on the vertical panel is 36 inches or more, use a stripe width of 6 inches.

TRAFFIC CONE

Provide retroreflectorization of cones more than 36" in height by alternating orange and white retroreflective stripes. Use a minimum of two orange and two white stripes for each cone with the top stripe being orange. Use maximum 3" nonretroreflective space between the orange and white stripes.

TUBULAR MARKER

Provide retroreflectorization of tubular markers more than 42" in height by alternating four 4" to 6" wide orange and white stripes with the top stripe being orange.

FLEXIBLE DELINEATOR

INSTALLATION NOTES:

1. Drill installation holes to diameter and depth required by manufacturer's specifications.
2. For removal, remove anchors and fill installation hole with an epoxy designed to bond to pavement surface.
3. In lieu of bolted down base, use an 8" x 8" butyl pad or hot melt butyl. Remove butyl as close as possible to pavement surface.

BARRICADE BLADE DETAIL

NOTE: This is the only type of rail acceptable for use with this barricade assembly.

ELEVATION VIEW

(A) Limitations when using 8'-0" barricade rails: 1) use no sign panel, and 2) extend no more than 1'-0" of the barricade rail past the uprights.

SIDE VIEW

Upright: 1 1/2" x 1 1/2" x 1/8" x 5'-0" Galv steel perforated tube
Sleeve: 1 3/4" x 1 3/4" x 14 gauge x 12" Galv steel perforated tube
Skid: 1 3/4" x 1 3/4" x 14 gauge x 5'-0" Galv steel perforated tube

BARRICADE ASSEMBLY DETAIL (Aluminum Barricade Rails)

NOTE: For barricade markings use alternating orange and white retroreflective stripes, sloping downward in the direction traffic is to pass. Place retroreflective sheeting on both sides of the rails with a minimum of 270 square inches of visible retroreflective area facing vehicular traffic. When the barricade length is less than 36", use a rail stripe width of 4".

TYPE I BARRICADE

Orange retroreflective: 6' to 10' length, 8" height, 45° slope, 6" width, 6" height, 3'-0" to 3'-6" width, Pavement or ground.

TYPE II BARRICADE

Orange retroreflective: 8" height, 45° slope, 6" width, 6" height, 3'-0" to 3'-6" width, Pavement or ground.

TYPE III BARRICADE

Orange retroreflective: Varies length, 8" height, 45° slope, 6" width, 6" height, Pavement or ground.

BARRICADE RAIL DETAILS

DELINERATORS

REFLECTOR DETAIL

ELEVATION

ELEVATION VIEW

Barricade rails: 1" x 8" wood slats or hollow-profile plastic rails
Upright: 1 1/2" x 1 1/2" x 12 gauge Galv steel perforated tube
Horizontal brace: 1 1/2" x 1 1/2" x 12 gauge Galv steel perforated tube
Sleeve: 1 3/4" x 1 3/4" x 12 gauge Galv steel perforated tube
Ballast: (see Table)
Skid: 1 3/4" x 1 3/4" x 12 gauge Galv steel perforated tube

SIDE VIEW

BARRICADE ASSEMBLY DETAIL (Wood or Plastic Rails)

MINIMUM BALLAST
(For each side of barricade support)

Without Sign	4 - 25 lb sandbags
With Sign	6 - 25 lb sandbags

Note: Number of sandbags based on a wind speed of 55 MPH. Sandbags assumed to be placed at or near the ends of the skids.

SECTION VIEW

Steel u-channel (1.12 lb/ft min to 2.0 lb/ft max)
1/4"Ø (typ)
1 1/16" min
2" min
1/4"Ø Fastener
One Direction
Bi-Directional

MOUNTING DETAIL

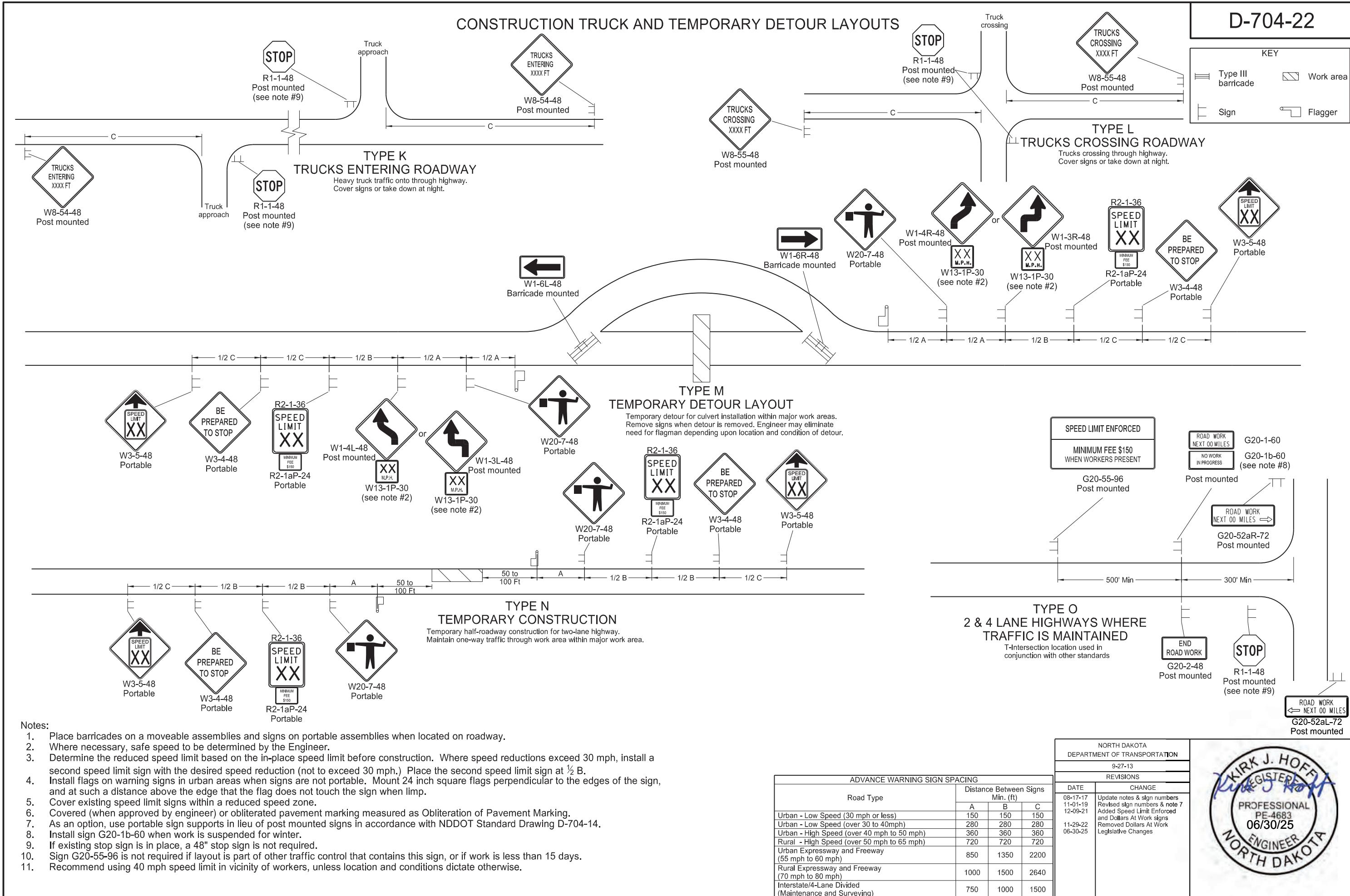
Roadway surface
1/4"Ø (typ)
R 1/2"

REFLECTOR DETAIL

ELEVATION

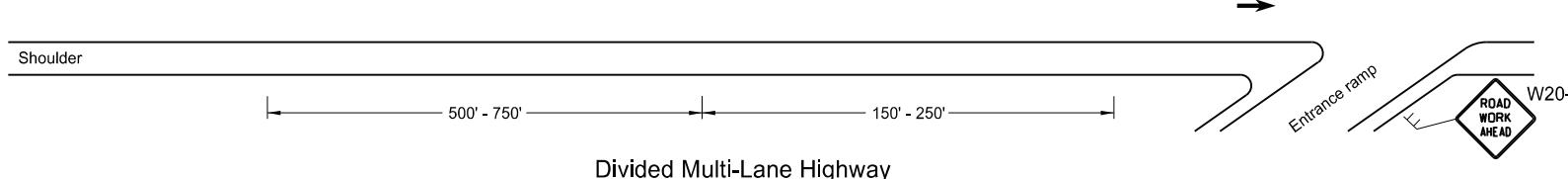
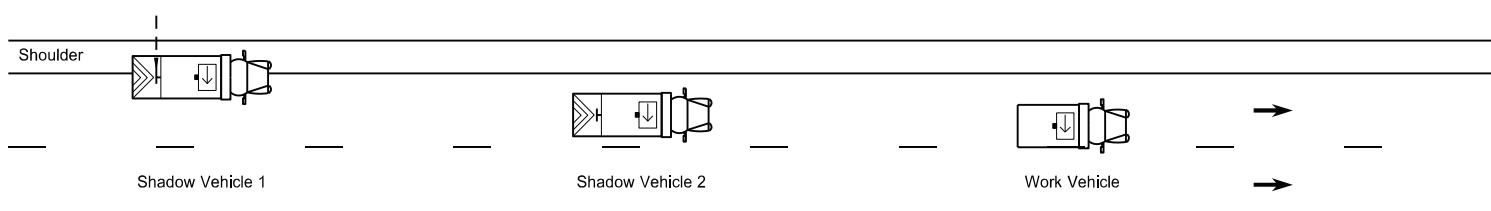
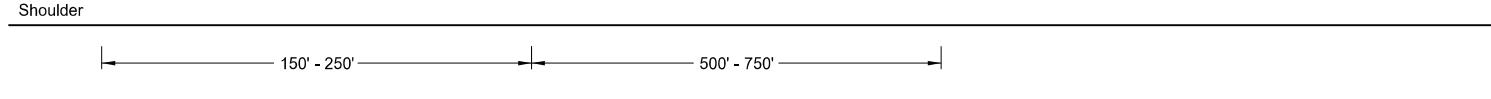
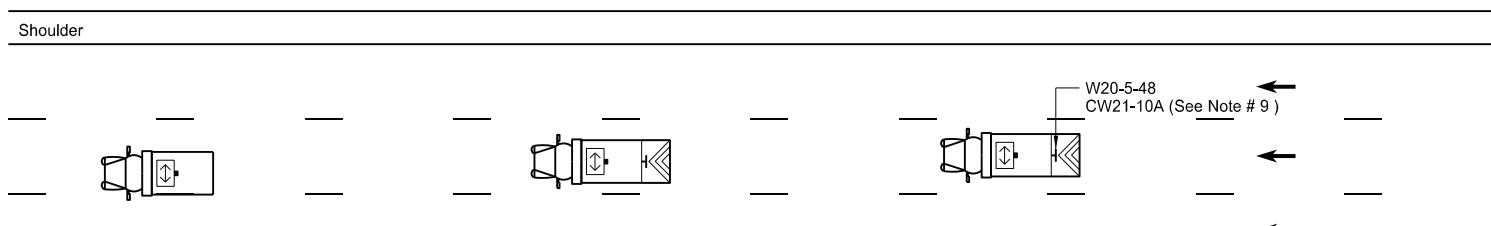
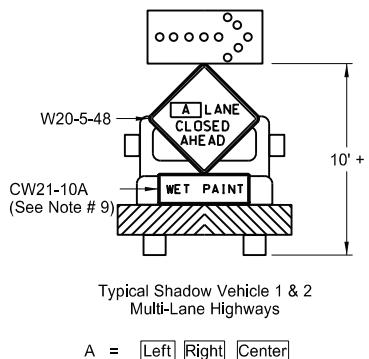
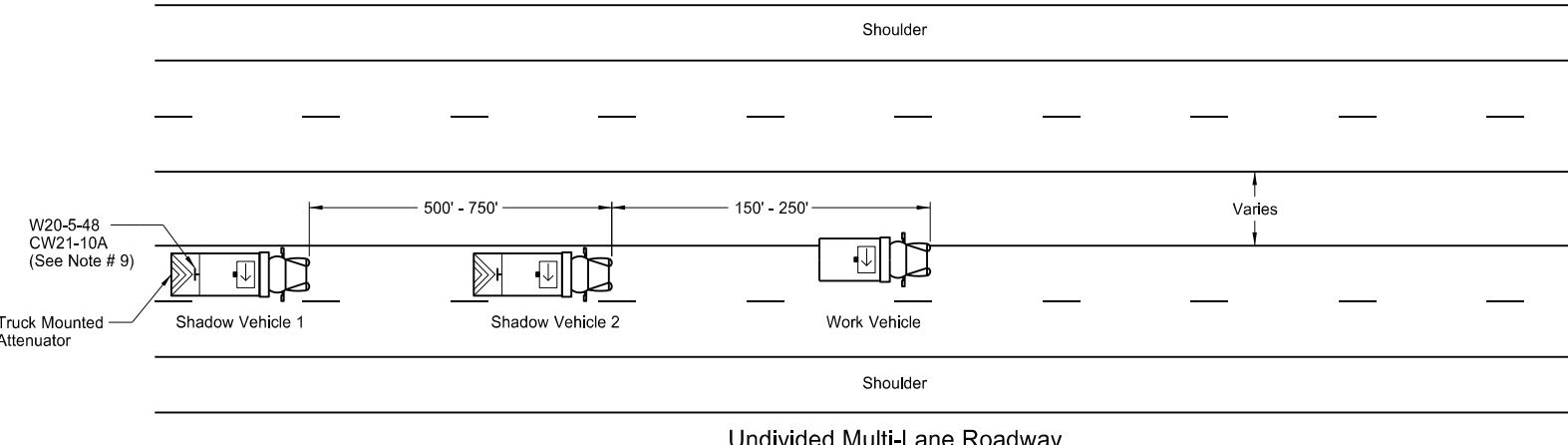
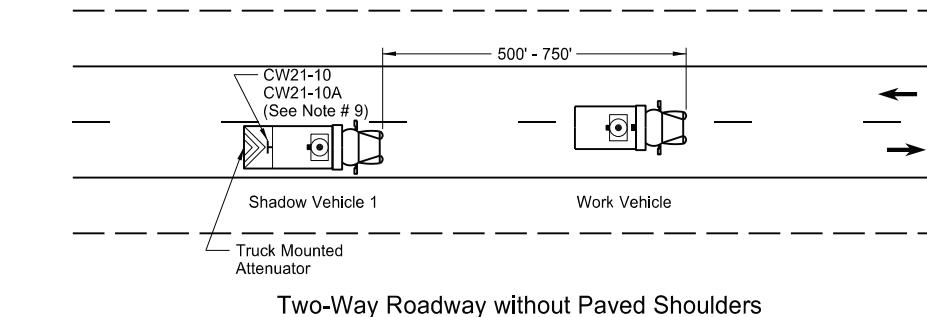
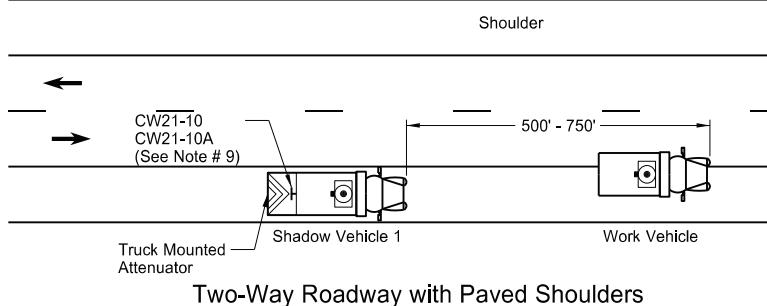
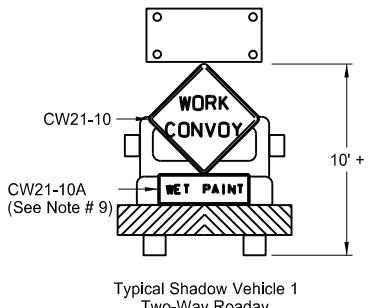
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-13	
REVISIONS	
DATE	CHANGE
9-27-17 11-01-19 8-01-24	Updated to active voice Revised details for Flexible Delineator Electronic Stamp/Signature

08/01/24

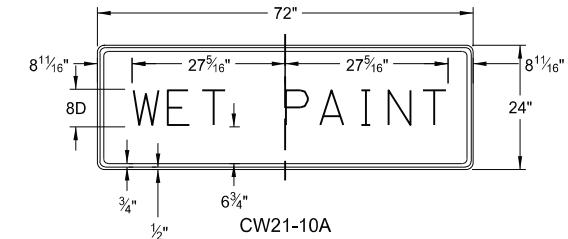
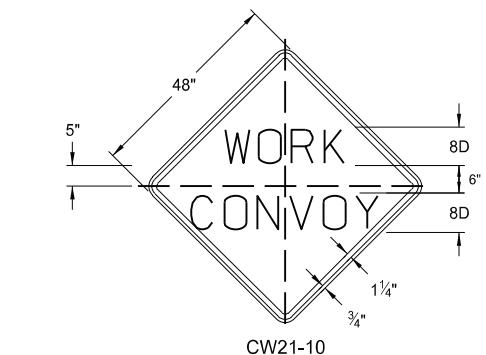


MOBILE OPERATION
(PAVEMENT MARKING)

D-704-27

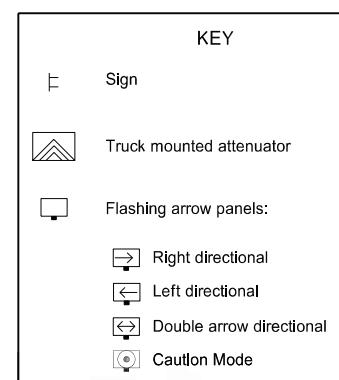


Sign Details



Notes

1. Use additional vehicles you choose to be in the convoy with truck mounted attenuators, at your own expense.
2. Display yellow rotating beacons or strobe lights on shadow and work vehicles, unless otherwise stated in the plans.
3. Use Type B or Type C flashing arrow panels controlled from inside the vehicle.
4. Provide each vehicle with two-way electronic communication capability.
5. Move shadow vehicle 1 first to shadow other convoy vehicles when convoy changes lane.
6. Vary vehicle spacing between shadow vehicle 1 and shadow vehicle 2 based on sight distance restrictions. Motorists approaching the work convoy need to see trail vehicle in time to slow down and/or change lanes as they approach shadow vehicle.
7. Sign Colors
Letters = Black
Border = Black
Background = Orange
8. As an option, use shadow vehicle 2 the paint tender vehicle.
9. Use sign CW21-10A only during painting operation.
10. Pull over work and shadow vehicles periodically to allow motor vehicle traffic to pass on two lane - two way roadways.



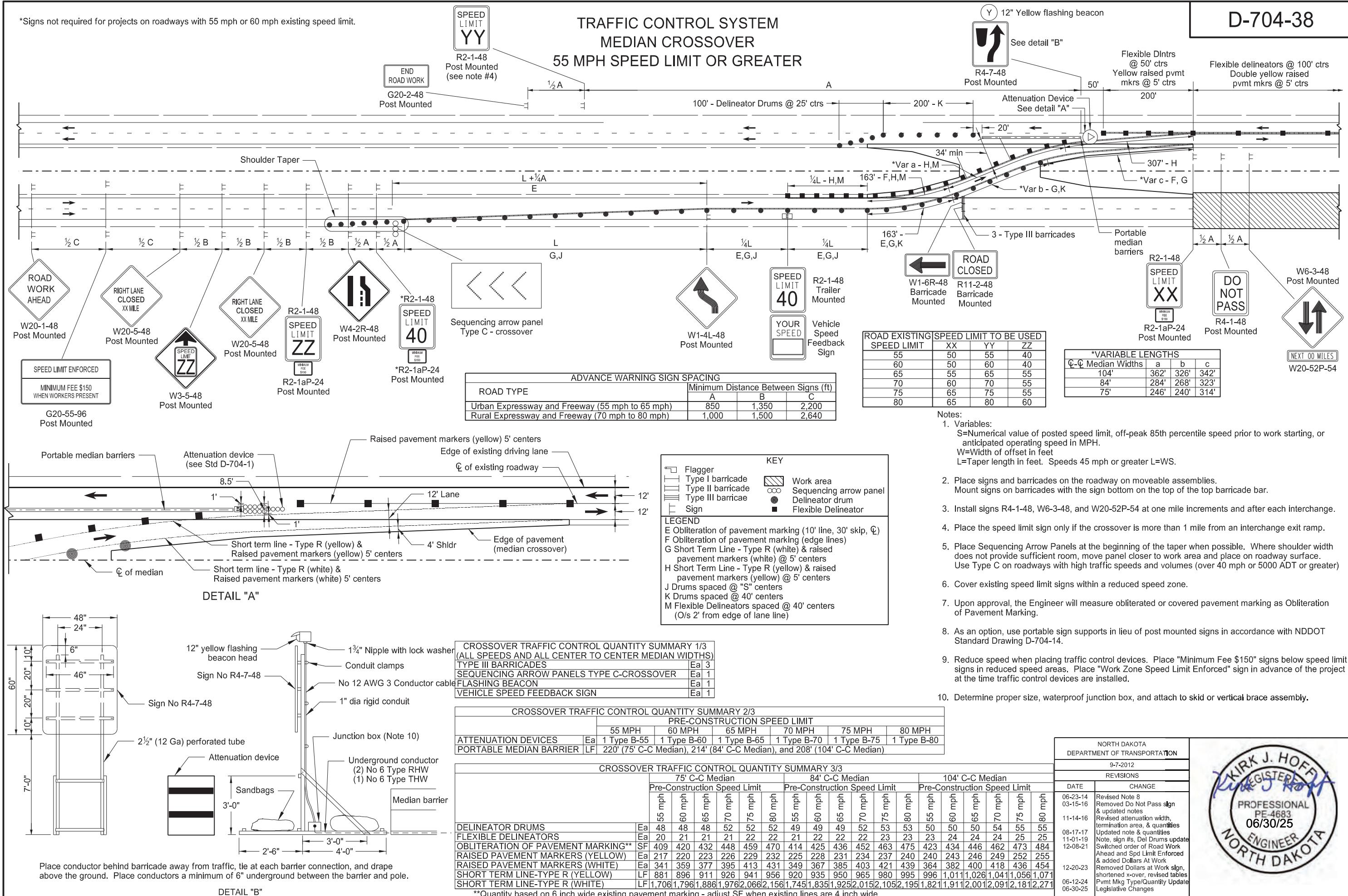
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-27-13	
REVISIONS	
DATE	CHANGE
6-18-14	Removed shadow vehicle 2 on two lane roadways
9-27-17 11-08-19 8-02-24	Updated to active voice Changed Standard Heading Electronic Stamp/Signature



*Signs not required for projects on roadways with 55 mph or 60 mph existing speed limit.

TRAFFIC CONTROL SYSTEM MEDIAN CROSSOVER 55 MPH SPEED LIMIT OR GREATER

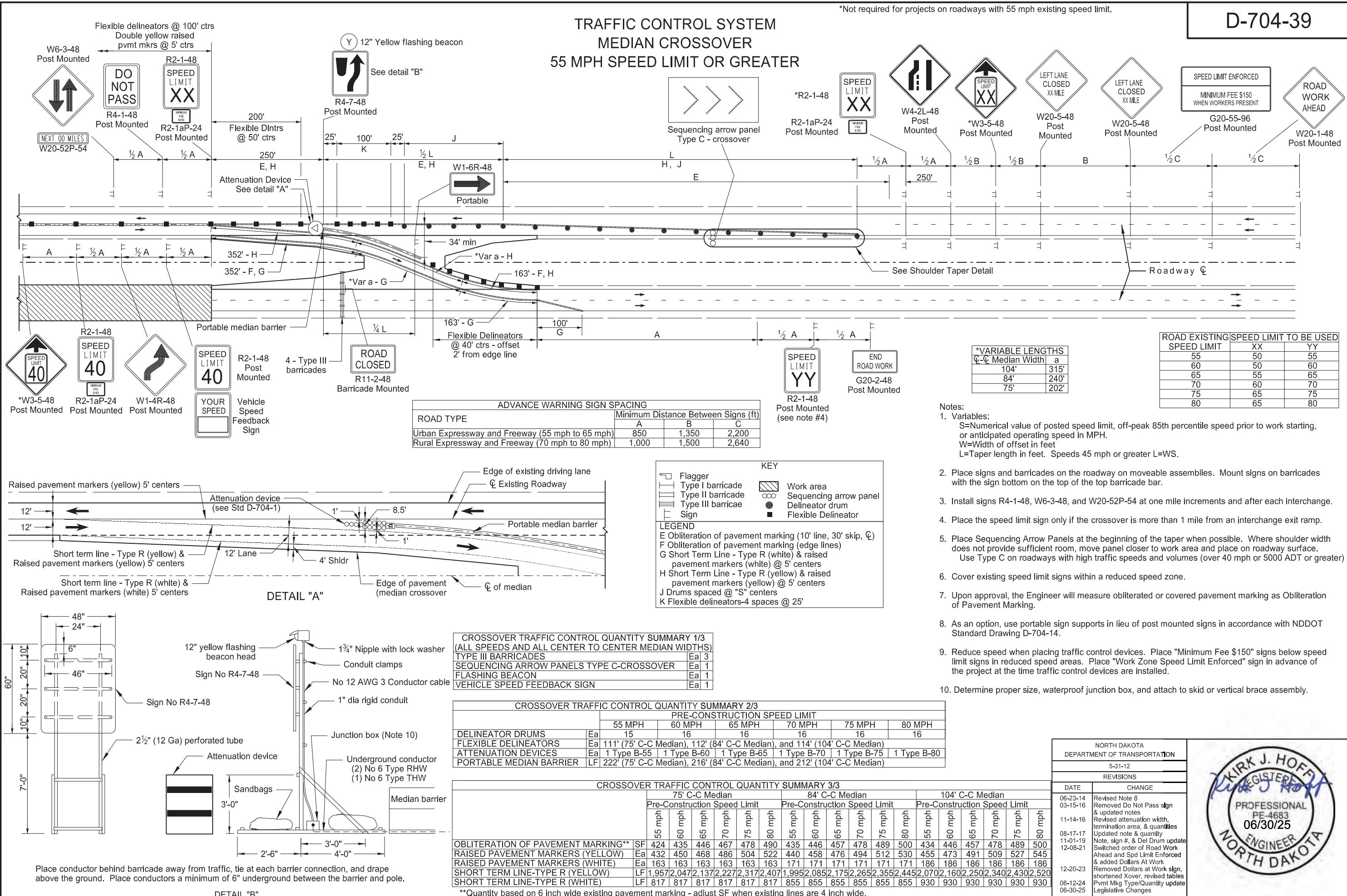
D-704-38



TRAFFIC CONTROL SYSTEM
MEDIAN CROSSOVER
55 MPH SPEED LIMIT OR GREATER

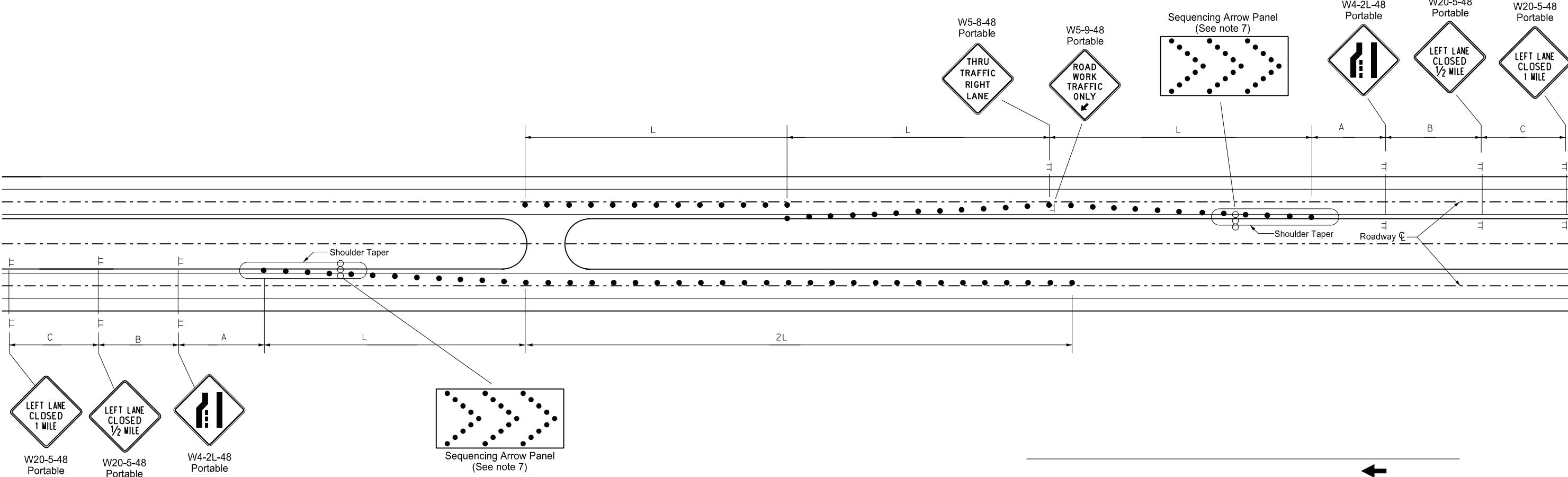
*Not required for projects on roadways with 55 mph existing speed limit.

D-704-39



CONSTRUCTION SIGN AND BARRICADE LOCATION DETAILS
CONSTRUCTION TRAFFIC MEDIAN CROSSING

D-704-49



Notes:

1. Include all costs for construction signing and devices in other items.
2. Remove construction signs and channelizing devices daily and barricade median access during nonworking hours.
3. Provide a minimum distance of one mile between the work area and the crossover. Use interchange access when the distance between work area and interchange is less than two miles.
4. Do not allow construction traffic to decelerate until they are well into crossover lane.

5. Variables:

S = Numerical value of speed limit or 85th percentile.

W = The width of taper

L = Minimum length of taper, or $S \times W$ for freeways, expressways, and all other roads with speeds of 45 mph or greater, or $W \times S \times 60$ for urban, residential, and other streets with speed of 40 mph or less

6. Space delineator drums, barricades or cones used for tapering traffic at dimension "S".

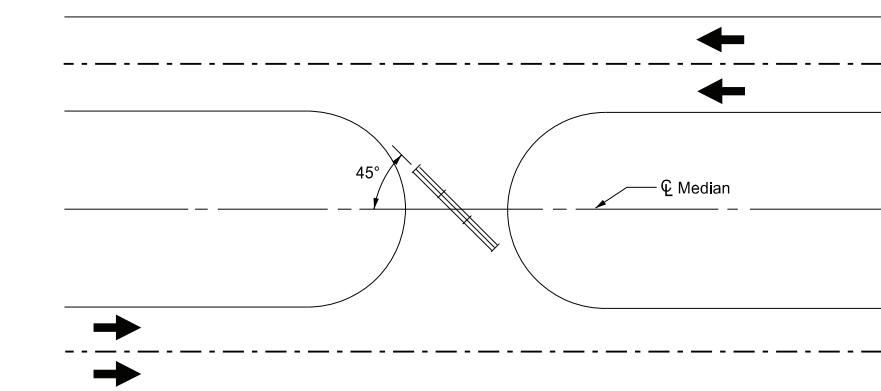
7. Sequencing Arrow Panels:

Place sequencing arrow panels at the beginning of the taper when possible. Where shoulder width does not provide sufficient room, move the panel closer to the work area and place on the roadway surface.

Use Type A on roadways with slow moving traffic speeds and low volume (25 mph or less and 750 ADT or less).

Use Type B on roadways with moderate traffic speeds and volumes (40 mph or less and 5000 ADT or less).

Use Type C on roadways with high traffic speeds and volumes (over 40 mph and over 5000 ADT).



BARRICADE LOCATION DETAIL

Install barricades at 45 degrees away from approaching traffic when median access is not in use.

ADVANCE WARNING SIGN SPACING			
Road Type	Distance Between Signs Min. (ft)		
	A	B	C
Urban - Low Speed (30 mph or less)	150	150	150
Urban - Low Speed (over 30 to 40 mph)	280	280	280
Urban - High Speed (over 40 mph to 50 mph)	360	360	360
Rural - High Speed (over 50 mph to 65 mph)	720	720	720
Urban Expressway and Freeway (55 mph to 60 mph)	850	1350	2200
Rural Expressway and Freeway (70 mph to 75 mph)	1000	1500	2640
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1000	1500

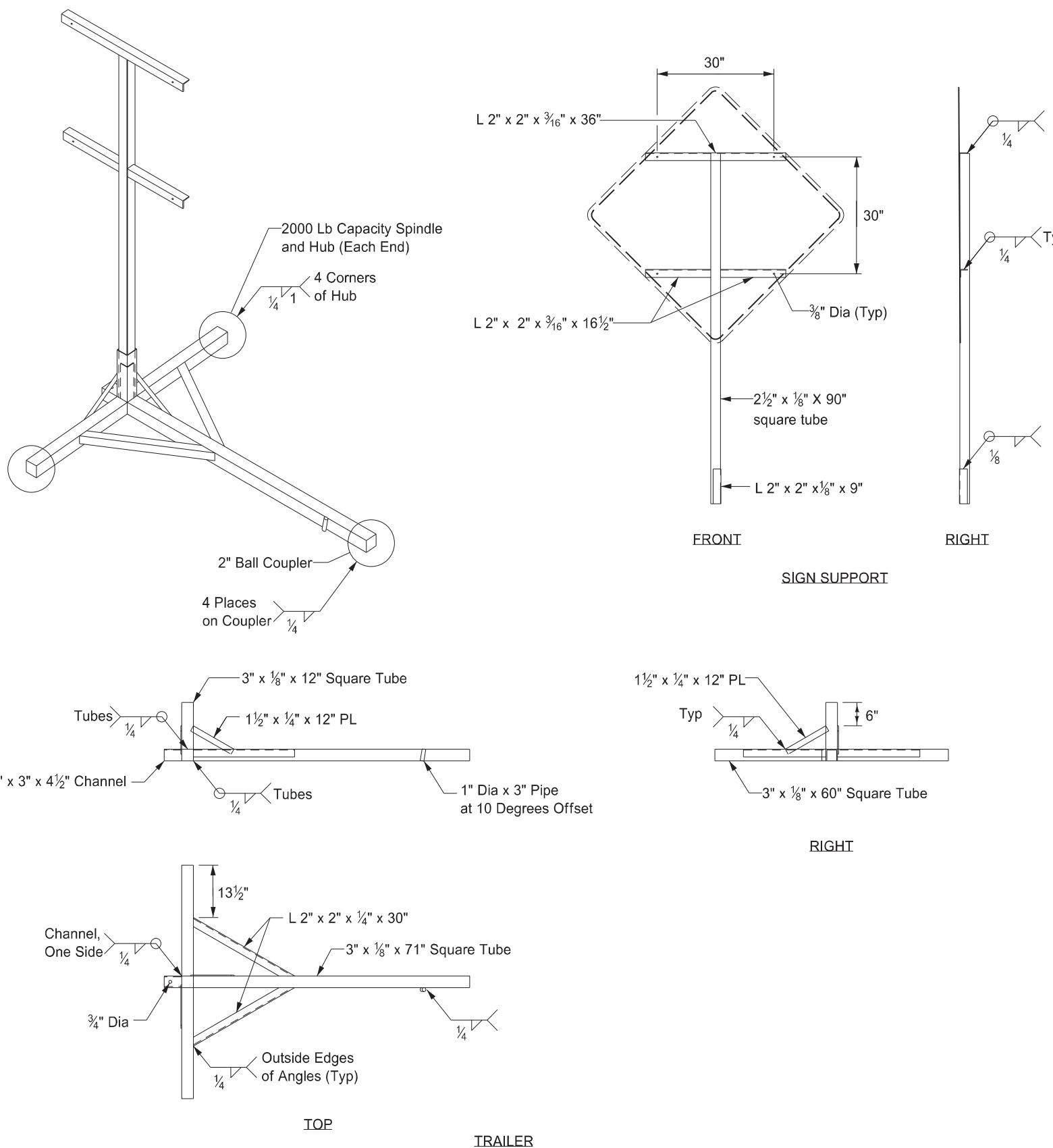
KEY	
—	Sign
●	Delineator Drum
○○○	Sequencing Arrow Panel
====	Type III Barricade

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-19-12	
REVISIONS	
DATE	CHANGE
06-24-14	Changed W5-9-48 to portable mounted.
09-06-19	Update Notes to active voice & New Design Engr PE Stamp.
11-01-19	Identified Shoulder Taper.
08-02-24	Electronic Stamp/Signature.



PORTABLE SIGN SUPPORT ASSEMBLY

D-704-50



Notes:

- ① Maximum 250 pound weight of assembly.
- ② Use a 14" wheel and tire.
- ③ Use no automotive and equipment axle assemblies for trailer-mounted sign supports.
- ④ Other NCHRP 350 or MASH crash tested assemblies are acceptable.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-23-10	
REVISIONS	
DATE	CHANGE
12/02/2020	Updated Note to active voice.

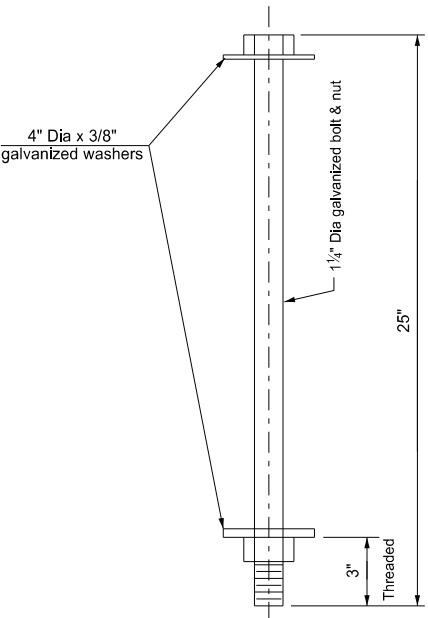


CONCRETE MEDIAN BARRIER
(TEMPORARY USAGE)

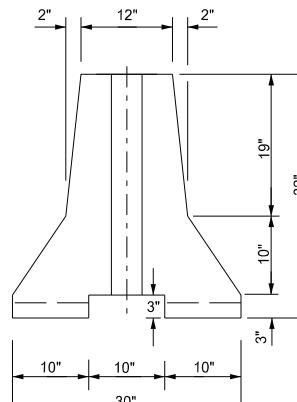
D-704-51

Notes:

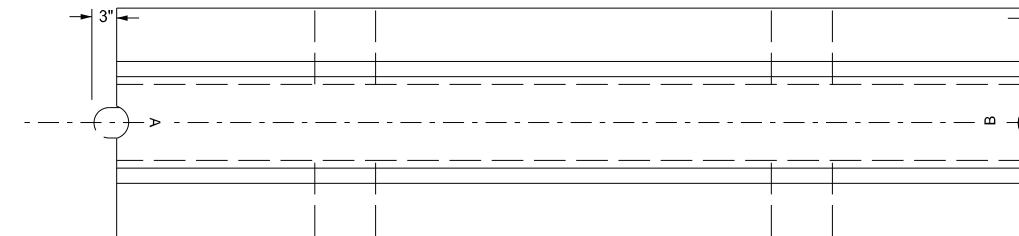
1. Barrier ends imprinted with 4 inch letters A and B. Field match A end with B end.
2. Place barrier markers at the center of the barrier at 20' centers.
3. Connect barrier sections with $1\frac{1}{4}$ " Dia A-307 double hex connecting bolt. Maintain bottom nut and washer connection for duration of barrier installation.
4. Place barrier to minimize openings between individual sections.



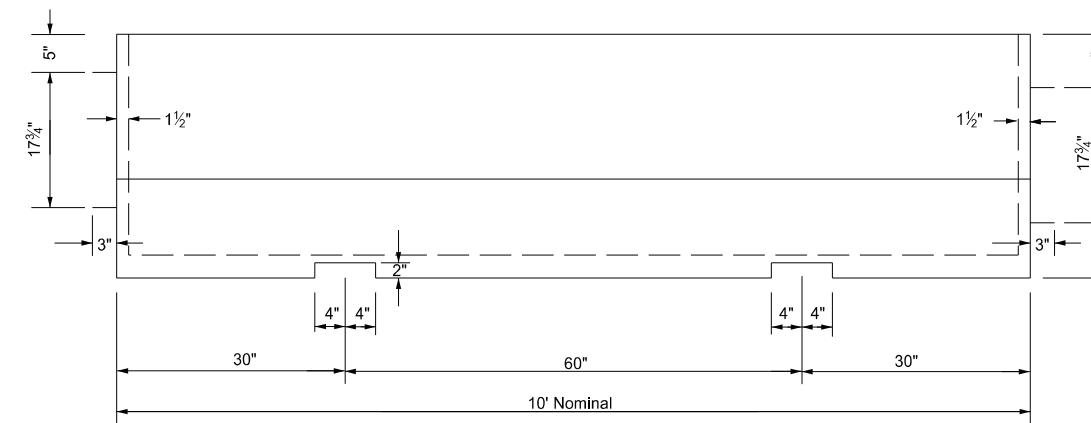
Connecting Bolt Detail
(One per 10 Ft section)



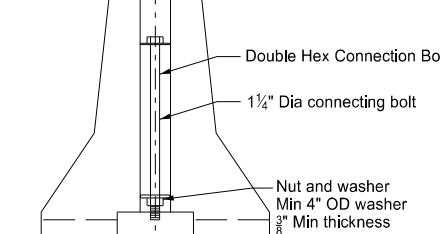
End View



Plan View



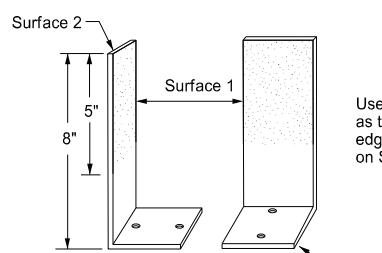
Side View



Bolt Connection Detail

Marker Body
Use high impact, weatherable engineering thermo-plastic material conforming to the following:

Property	Result	ASTM Test Method
Thickness (min)	.090"	
Tensile strength (min psi) @ yield	5,500	D638
Impact strength @ -20°F (ft-lbs/in of notch)	3.2	D256 Method A
Impact strength @ 73°F (ft-lbs/in of notch)	14.0	D256 Method A
Flexural strength, PSI 1/4" @ 73°F	8,000	D790
Flexural modulus, PSI 1/4" @ 73°F	300,000	D790
Elongation @ yield	30%	D638



Use same color reflective faces as the edge line along barrier edge. Two way reflective on Surface 1 & 2.

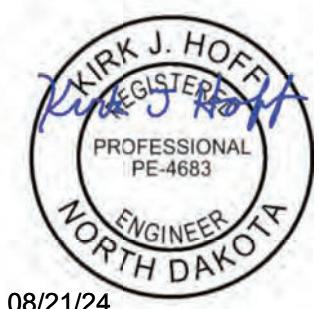
Barrier Marker Detail

Reflective Tape
Use retroreflective, acrylic micropism material with acrylic backing, 3" wide, providing the following minimum optical performance with an observation angle of 0.1° measured in candlepower for the reflector:

Entrance Angle	Specific Intensity
Yellow - 4"	136
White - 4"	200

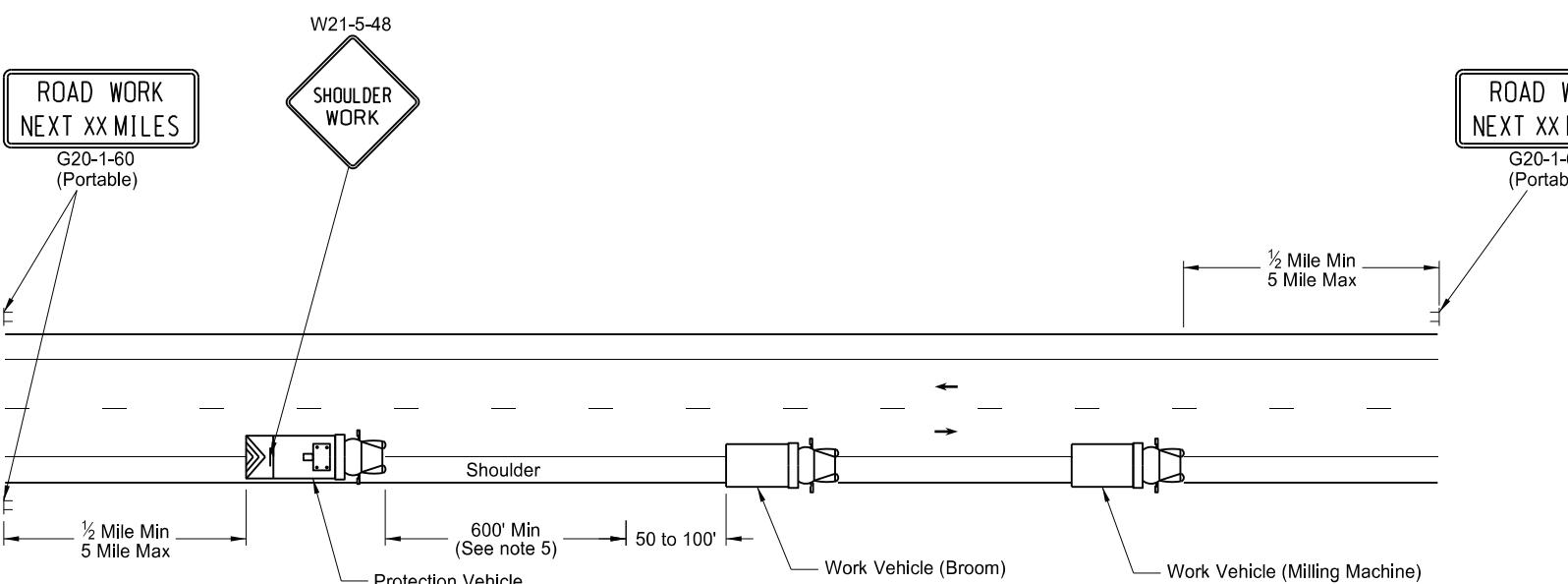
Adhesive
Use factory applied solid butyl rubber $\frac{1}{8}$ " thick, 2" wide on $2\frac{1}{2}$ " wide release paper on surface 3 to temporarily mount markers to portable concrete barrier.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07-20-12	REVISIONS
DATE	CHANGE
9-27-17 11-01-19 8-21-24	Updated to active voice New Design Engr PE Stamp Removed Fabrication Info

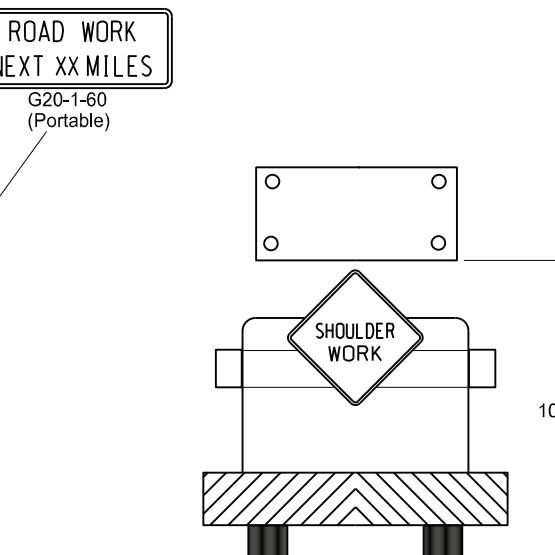


MOBILE OPERATION
Grinding Shoulder Rumble Strips

D-704-56

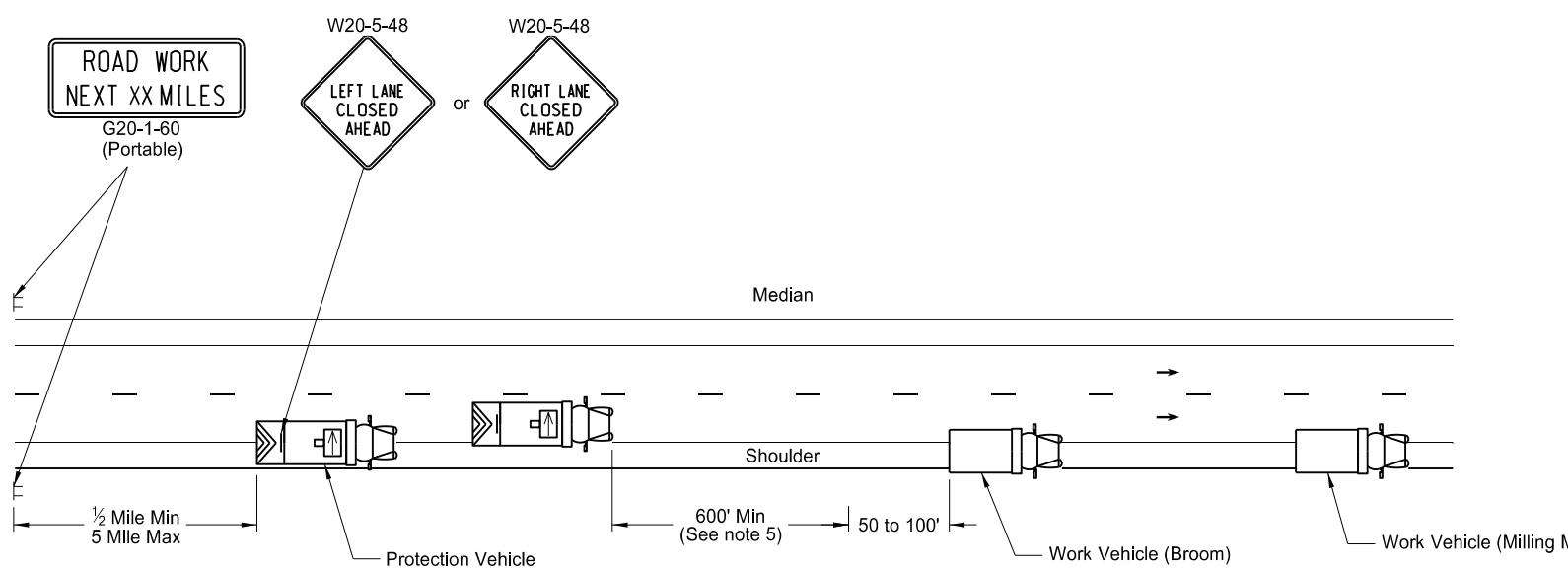


TWO LANE - TWO WAY ROADWAY

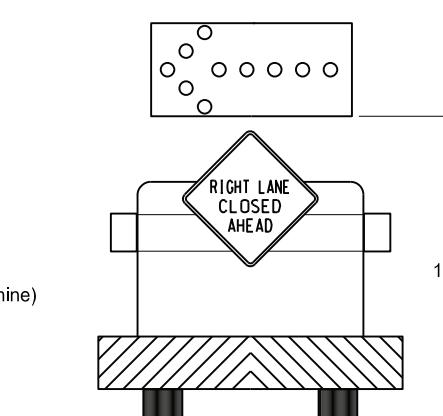


TWO LANE - TWO WAY ROADWAY

Typical Protection Vehicle with
Flashing Arrow Panel In Caution Mode

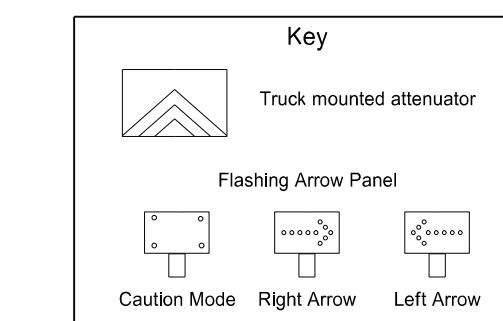


INTERSTATE & 4 LANE DIVIDED HIGHWAY

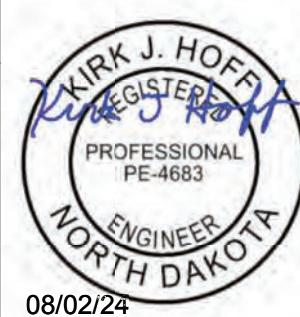


INTERSTATE & 4 LANE DIVIDED HIGHWAY

Typical Protection Vehicle with Flashing Arrow Panel In Flashing Arrow Mode

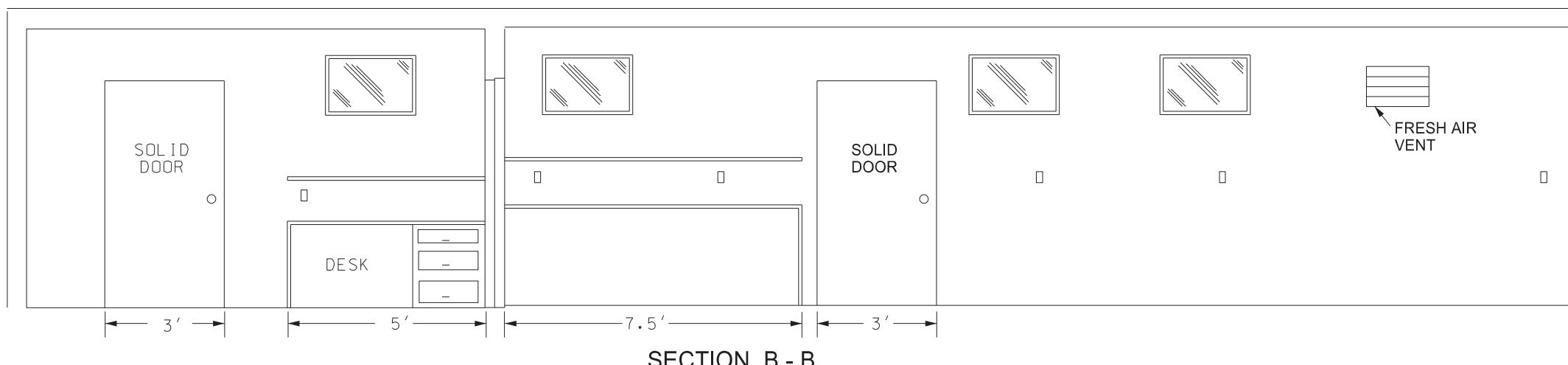
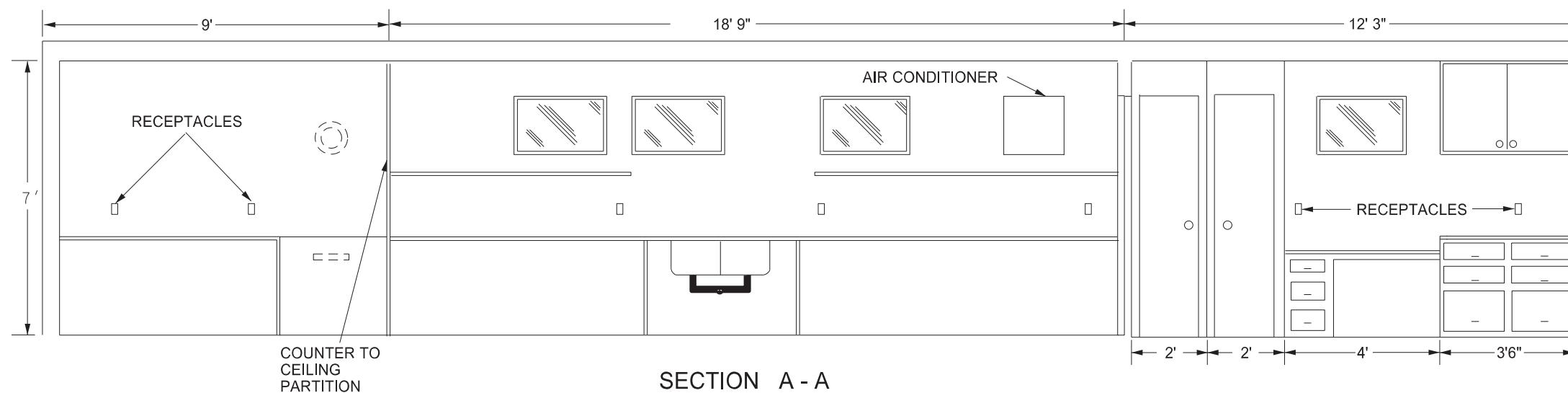
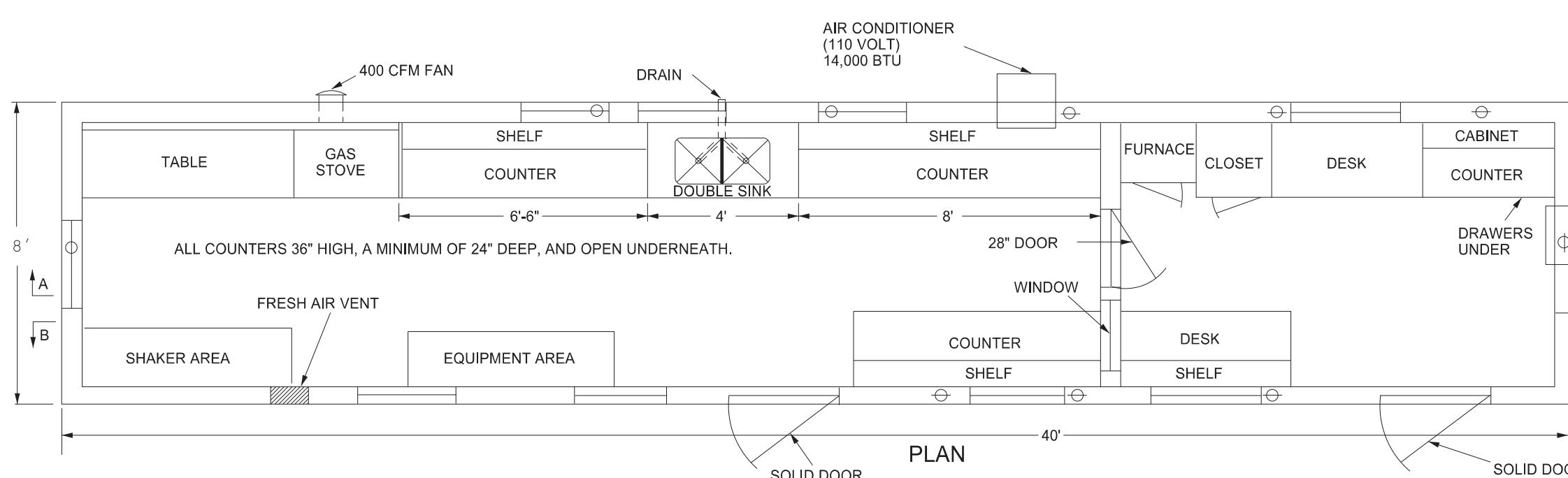


NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-15-12	
REVISIONS	
DATE	CHANGE
8-17-17 10-03-19 8-02-24	Updated notes & signs New Design Engineer PE Stamp Electronic Stamp/Signature

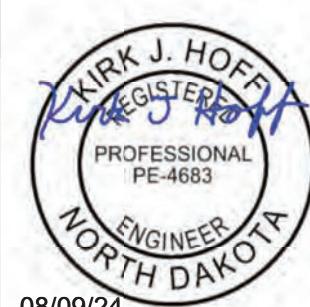


BITUMINOUS LABORATORY

D-706-1



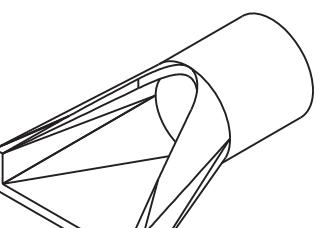
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-03-13	
REVISIONS	
DATE	CHANGE
07-30-14	Changed standard's title and revised notes.
01-11-16	Revised notes.
08-27-19	New Design Engineer PE Stamp
08-09-24	Electronic Stamp/Signature.



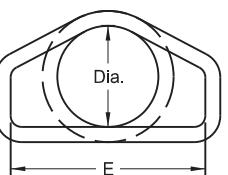
REINFORCED CONCRETE PIPE CULVERTS AND END SECTIONS

(Round Pipe)

FLARED END SECTION						
TERMINAL DIMENSIONS						
DIA	A	B	C	D	E	U
12	0'-4"	2'-0"	4'-0 1/8"	6'-0 1/8"	2'-0"	2"
15	0'-6"	2'-3"	3'-10"	6'-1"	2'-6"	2 1/4"
18	0'-9"	2'-3"	3'-10"	6'-1"	3'-0"	2 1/2"
21	0'-9"	3'-0"	3'-1"	6'-1"	3'-6"	2 3/4"
24	0'-9 1/2"	3'-7 1/2"	2'-6"	6'-1 1/2"	4'-0"	3"
27	0'-10 1/2"	4'-0"	2'-1 1/2"	6'-1 1/2"	4'-6"	3 1/4"
30	1'-0"	4'-6"	1'-7 3/8"	6'-1 1/2"	5'-0"	3 1/2"
36	1'-3"	5'-3"	2'-9"	8'-0"	6'-0"	4"
42	1'-9"	5'-3"	2'-9"	8'-0"	6'-6"	4 1/2"
48	2'-0"	6'-0"	2'-0"	8'-0"	7'-0"	5"
54	2'-3"	5'-5"	2'-9 1/4"	8'-2 1/4"	7'-6"	5 1/2"
60	2'-11"	5'-0"	3'-3"	8'-3"	8'-0"	5"
66	2'-6"	6'-0"	2'-3"	8'-3"	8'-6"	5 1/2"
72	3'-0"	6'-6"	1'-9"	8'-3"	9'-0"	6"
78	3'-0"	7'-6"	1'-9"	9'-3"	9'-6"	6 1/2"
84	3'-0"	7'-6 1/2"	1'-9"	9'-3 1/2"	10'-0"	6 1/2"
90	3'-5"	7'-3 1/2"	2'-0"	9'-3 1/2"	11'-0"	6 1/2"

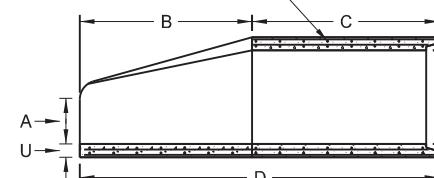


PERSPECTIVE

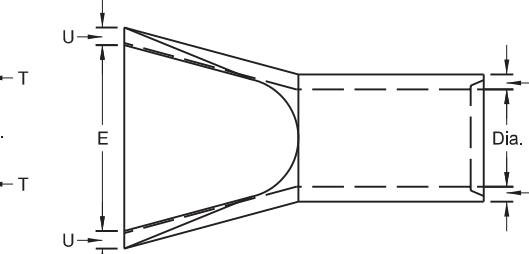


END VIEW

Standard Reinforcement for Class III pipe
reinforced as per AASHTO M170



SIDE VIEW

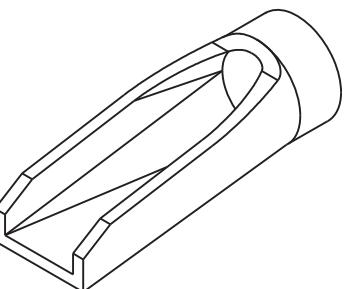


TOP VIEW

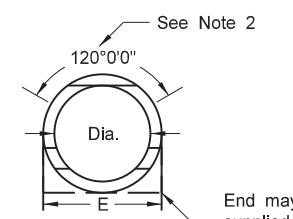
NOTES:

- All reinforcing steel shall meet AASHTO M170 requirements.
- All circular, longitudinal, and elliptical reinforcement shall be assembled and securely fastened in cage fashion so as to maintain reinforcement in exact shape and correct positions within the forms.
- Laying length of pipe: 12" to 66" (incl.) = not less than 4 feet
66" to 108" (incl.) = not less than 6 feet
- Joints shall be sealed with rubber gaskets or with sealer approved by the engineer whenever pipe are specified for storm drain or sanitary sewers.
- For Class IV and Class V reinforced concrete pipe and end section sizes which do not have reinforcement specified by AASHTO M170, shop drawings and design calculations shall be prepared and sealed by a Professional Engineer and submitted for the Engineer's review.

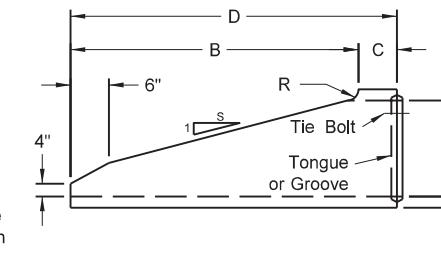
TRaversable END SECTION						
DIA	B	C	D	E	R	S
15"	4'	9"	4'-9"	1'-7 1/2"	3"	6
18"	5'-9"	9"	6'-6"	1'-11"	3"	6
24"	6'	1'	7'	2'-6"	3"	4
30"	7'-6"	1'	8'-6"	3'-1"	3 1/2"	4
36"	7'-3"	15"	8'-6"	3'-8"	3"	4



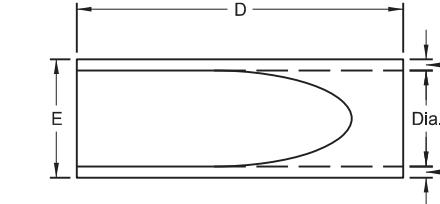
PERSPECTIVE



END VIEW



SIDE VIEW

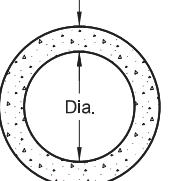


TOP VIEW

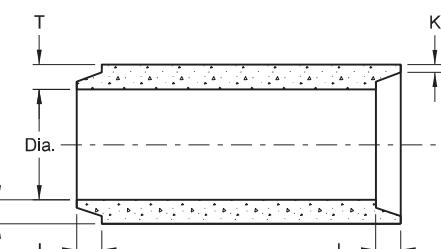
NOTES (Traversable End Section):

- Manufactured in accordance with applicable portions of ASTM C76/AASHTO M170.
- Reinforcement per Class III RCP with double reinforcement in the upper 120° of the full barrel portion.

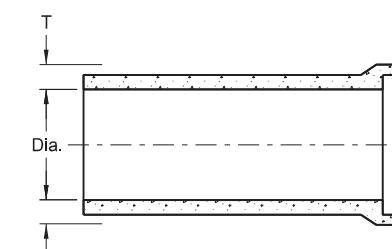
All Classifications of Round Concrete Pipe						
Internal Dia. of pipe in inches	Cross-Sectional Water Area	Weight per lin. ft. of pipe	Side Wall	Joint Gage Min. & Max.	Tongue End Min. & Max.	Minimum Wall Thickness (T)
Dia.	Sq. ft.	Lbs.	In.	In.	In.	In.
12	0.79	92	1 1/8-2 1/8	3/4	2 1/2	2
15	1.23	127	1 1/4-2 1/4	7/8	2 1/4	
18	1.77	168	1 1/8-2 1/8	1	2 1/2	
21	2.40	214	1 1/8-3 1/8	1 1/8	2 1/4	
24	3.14	265	2 1/4-3 1/4	1 1/8	3	
27	3.98	322	2 1/4-4	1 1/4	3 1/4	
30	4.91	384	3 1/4-4 1/4	1 1/4	3 1/2	
33	5.94	452	3 1/4-4 1/4	1 1/2	3 1/4	
36	7.07	524	3 1/4-4 1/4	1 1/2	4	
42	9.62	685	3 1/4-4 1/4	1 1/4	4 1/2	
48	12.57	685	3 1/4-4 1/4	1 1/8	5	
54	15.90	1070	4 1/2-5 1/4	2	5 1/2	
60	19.63	1296	4 1/2-5 1/2	2 1/4	6	
66	23.76	1542	5-6	2 1/8	6 1/2	
72	28.27	1810	5 1/8-6 1/4	2 1/8	7	
78	33.18	2098	6 1/4-7 1/4	2 1/8	7 1/2	
84	38.48	2410	5 1/8-7 1/4	3 1/8	8	
90	44.18	2793	6 1/4-8 1/2	3 1/8	8 1/2	
96	50.27	3092	7-8 1/4	3 1/2	9	
102	56.75	3466	7-8 1/4	3 1/2	9 1/2	
108	63.62	3864	7 1/4-8 1/2	3 1/4	10	



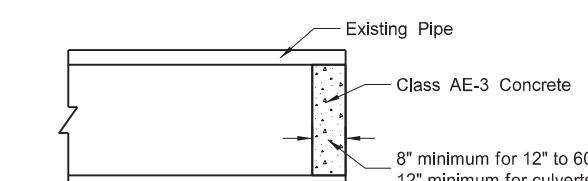
END VIEW



TONGUE & GROOVE JOINT



BELL & SPIGOT JOINT



CONCRETE PIPE PLUG

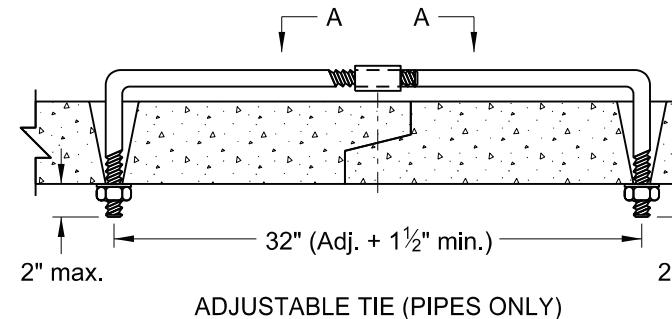
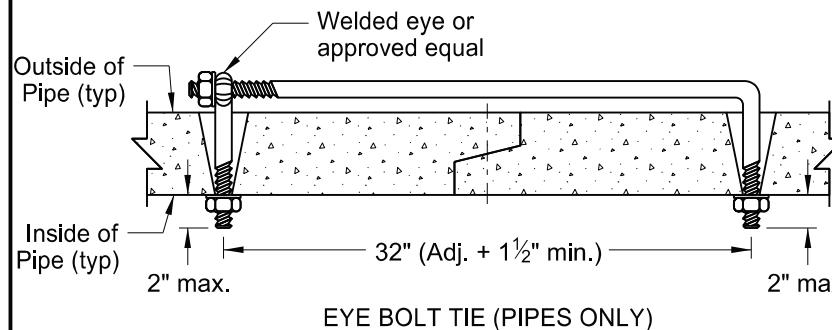
JOINTS FOR REINFORCED CONCRETE PIPE

CIRCULAR PIPE

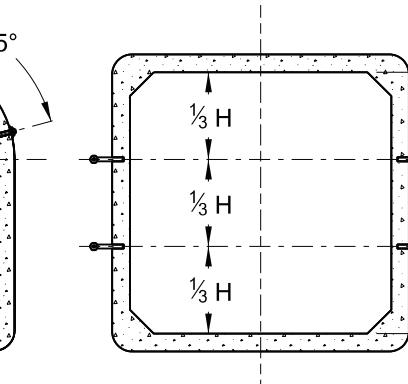
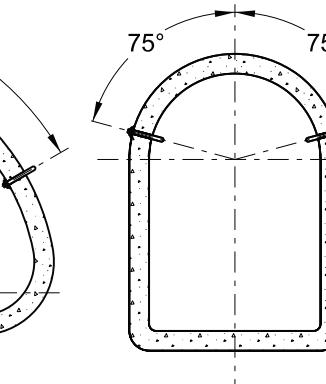
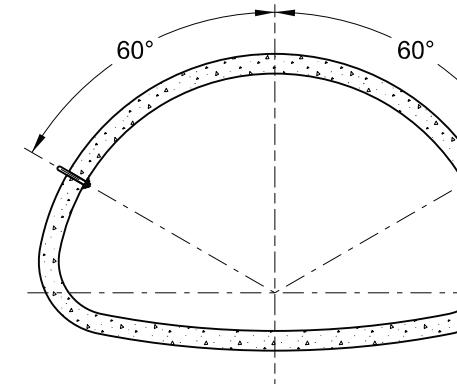
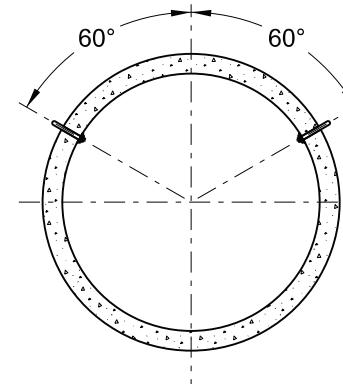
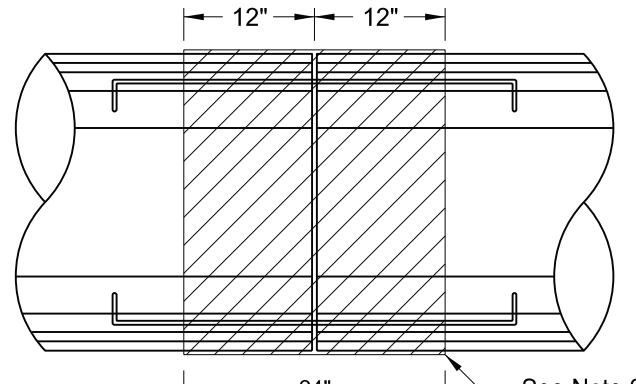
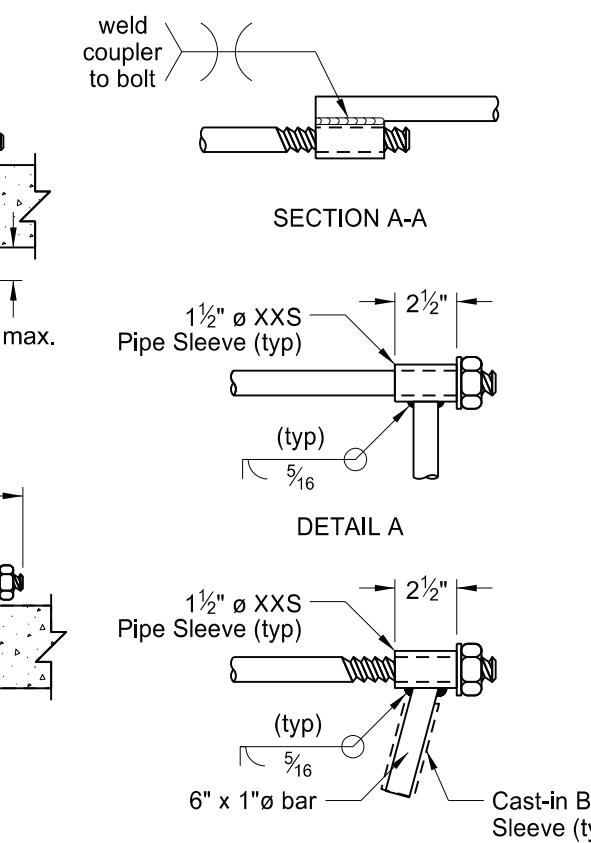
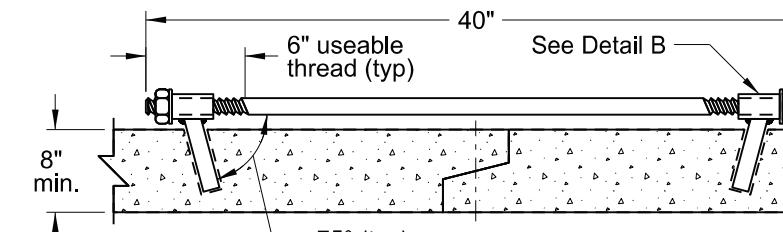
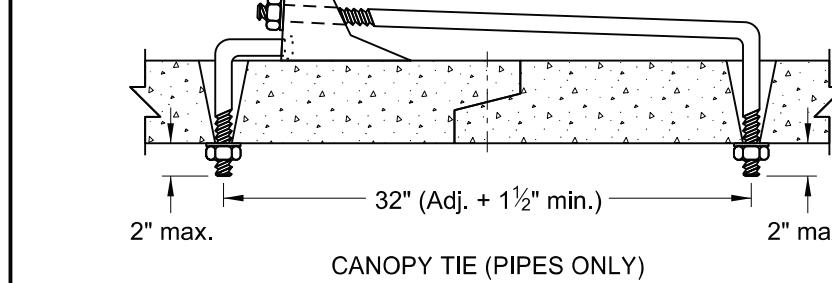
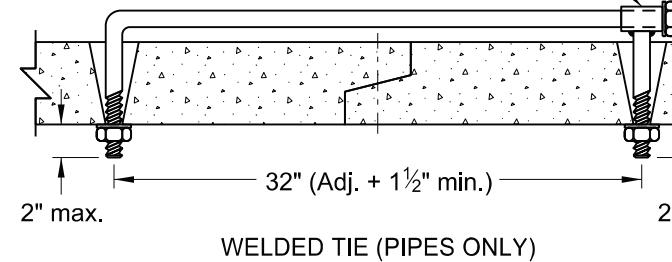
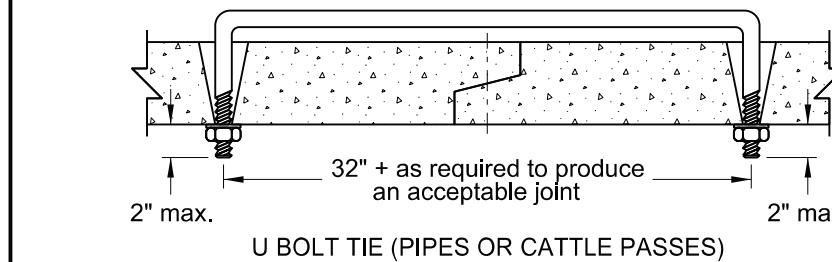
SEE STANDARD DRAWING D-714-22 FOR DETAILS
OF CONCRETE PIPE TIES (TIE BOLTS).

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
05-12-14	
REVISIONS	
DATE	CHANGE
01-21-15 11-21-16 09-18-19	Revised Note 5 Revised End Section Dimensions Updated Perspective View Details

This document was originally
issued and sealed by
Jon Ketterling
Registration Number
PE-4684,
on 9/18/19 and the original
document is stored at the
North Dakota Department
of Transportation

CONCRETE PIPE, CATTLE PASS, OR
PRECAST CONCRETE BOX CULVERT TIES

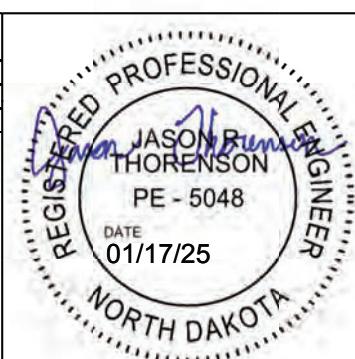
REQUIRED SIZE OF TIE BOLTS		
PIPE SIZE	THREAD Ø	XXS PIPE SLEEVE INNER Ø
18" - 24"	5/8" SEE NOTE 3	3/4"
30" - 66"	3/4"	1"
72" - 120"	1"	1 1/4"
RCB/CATTLE PASS		



NOTES:

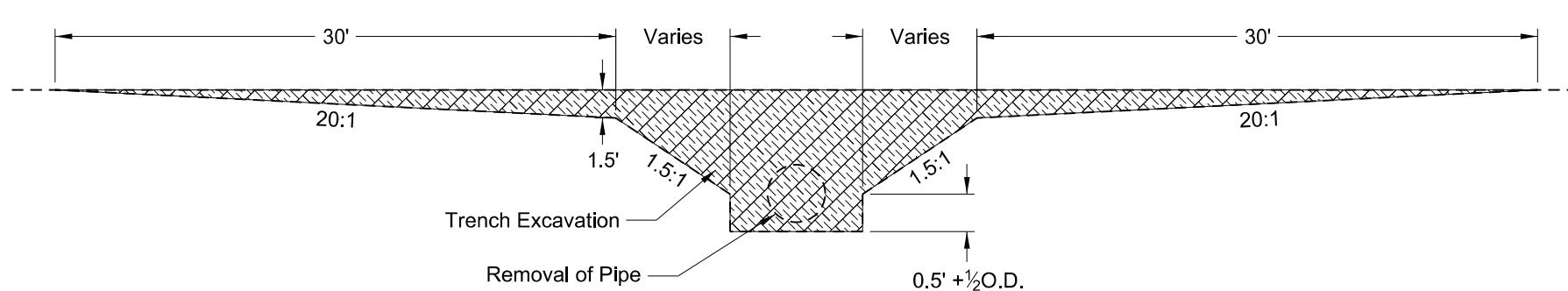
- The pipe size listed is the inside diameter of round pipe or the equivalent diameter of pipe arch.
- Insert pipe ties from the inside of the pipes and grout into place for Cattle Pass and Jacked and Bored pipes. Jacked and bored pipes with a diameter of 24" or less do not require pipe ties.
- Nuts and washers are not required on Jacked and Bored pipes or pipes with a 24" diameter or less. Insert and grout tie bars into place where nuts and washers are not used.
- Do not use pipe ties to pull the pipe or RCB sections tight. The ties are only for holding sections together.
- Use only tie bolt assemblies that have been hot dip galvanized in accordance with ASTM A 153.
- Holes in pipes to accommodate tie bolts will be precast. Tapered holes are permitted. Use holes that have a diameter 1/4" larger than the diameter of the thread. In precast RCB's, use holes that contain cast-in bolt sleeves with an inside diameter of 1 1/4".
- Include the cost of precasting the required holes and furnishing and installing the tie bolts in the price bid for the appropriate conduit or RCB pay item.
- Tie all centerline and approach RCP culvert joints. Tie all joints including the end sections of all free ends of storm drain systems. Free ends are defined as any storm drain end which does not terminate at an inlet or manhole. Outfall culverts with end sections which drain adjacent ditches are examples of free ends.
- Place joint wrap prior to installing ties. Firmly secure the wrap around the full perimeter. For concrete pipes, use Type S2 geotextile fabric and overlap the joint by 12" in both directions. For box culverts, use a waterproof membrane that meets ASTM C990. Provide a membrane that is a minimum of 12" wide and center it at the joint. Provide a minimum overlap of 2.5" at the seams.
- Use tie bolts that conform to ASTM A 36. Use heavy hex nuts that conform to ASTM A 563. Use washers that conform to ASTM F 436, Type 1. Use welded pipe sleeves and cast-in bolt sleeves that conform to ASTM A 53, Grade B.
- Provide lock washers or burr threads of concrete box ties after installation and tightening to prevent nut rotation.
- Tie RCB's as noted in the plans.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
3-18-14	
REVISIONS	
DATE	CHANGE
7-21-15 6-6-17	Note 8 Notes 2-11 Table, Title, Labels
8-11-21 01-17-25	Notes 2-12 Table, Label Notes 9-13 Table, Labels Section A-A, End View



TRANSVERSE MAINLINE PIPE INSTALLATION DETAIL
PIPES 4 FEET OR LESS BELOW TOP OF SUBGRADE

D-714-26

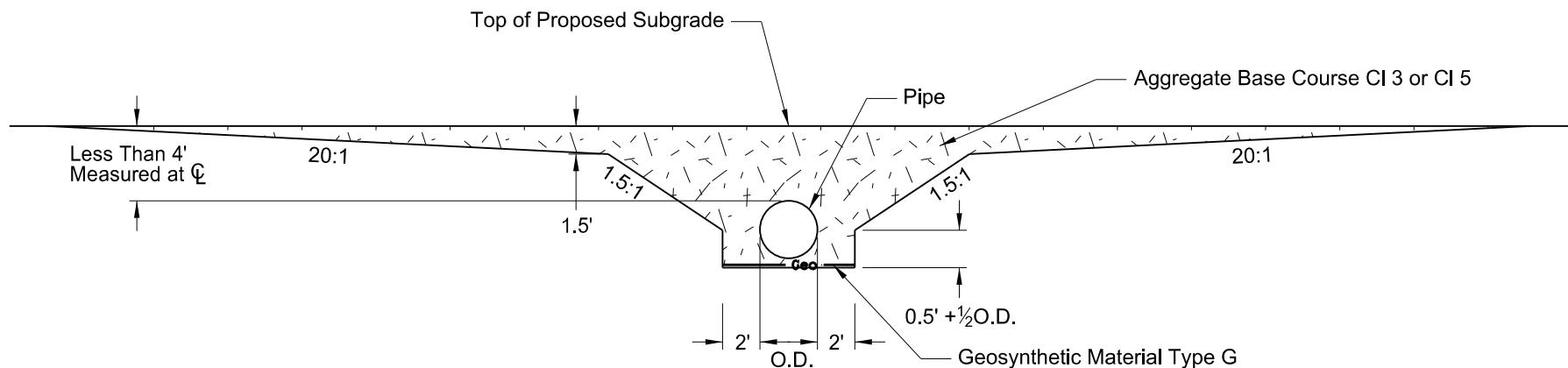


Pay Items
1) Pipe*
2) Geosynthetic Material Type G
3) Removal of Pipe (if required)

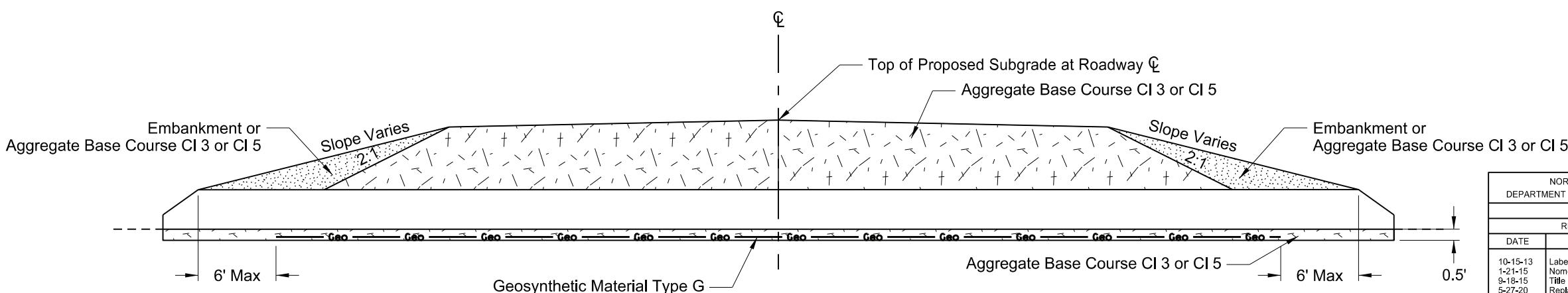
*Included in Pipe Pay Item
1) Pipe
2) Trench Excavation
3) Aggregate Base Course CI 3 or CI 5
4) Embankment

NOTES:

- 1) This drawing applies to new/replaced mainline and paved intersection roadway pipes only (including ramps). It does not include pipes in approaches.
- 2) Embankment may be either borrow Excavation or Common Excavation - Type A

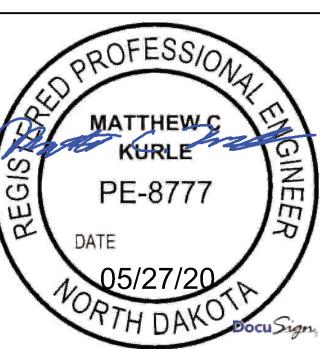


INSTALLATION DETAIL



CROSS SECTION

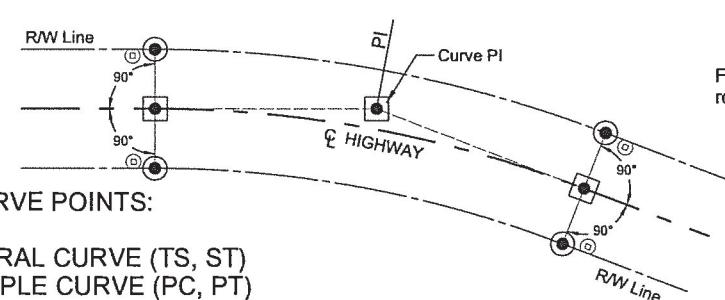
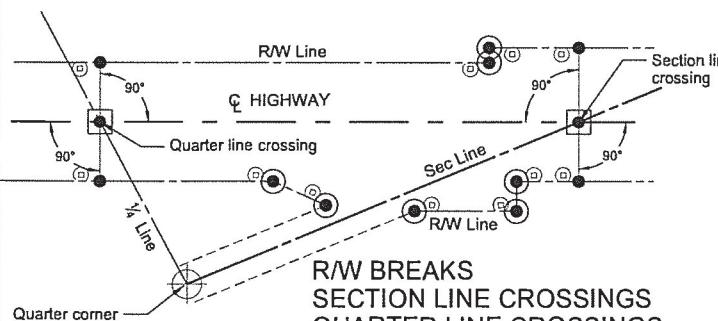
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
7-26-13	
REVISIONS	
DATE	CHANGE
10-15-13 1-21-15 9-18-15 5-27-20	Label Formatting Nomenclature Title Rewording Replaced R1 Fabric with Geogrid Changed bedding depth



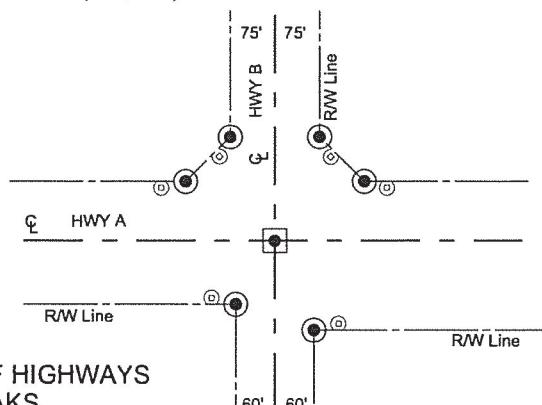
RECYCLED PLASTIC
RIGHT OF WAY MARKER
(WITNESS POST) DETAILS
&
IRON PIN REFERENCE AND R/W
MONUMENT DETAILS

IRON PIN REFERENCE AND R/W MONUMENT DETAILS

VARIOUS MONUMENT AND MARKER PLACEMENTS

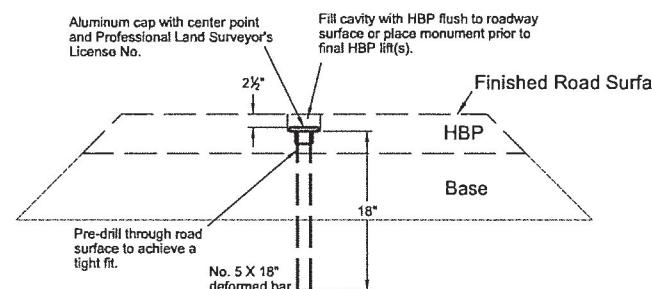


CURVE POINTS:
PI
SPIRAL CURVE (TS, ST)
SIMPLE CURVE (PC, PT)

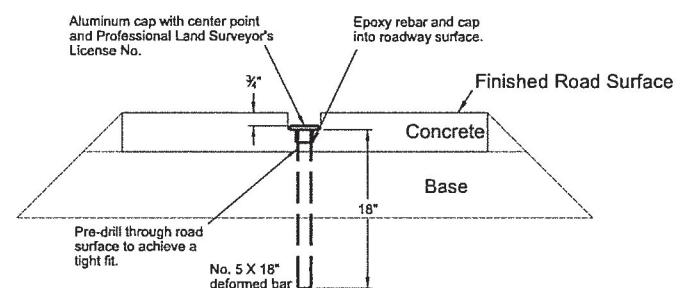


INTERSECTION OF HIGHWAYS FLARED R/W BREAKS

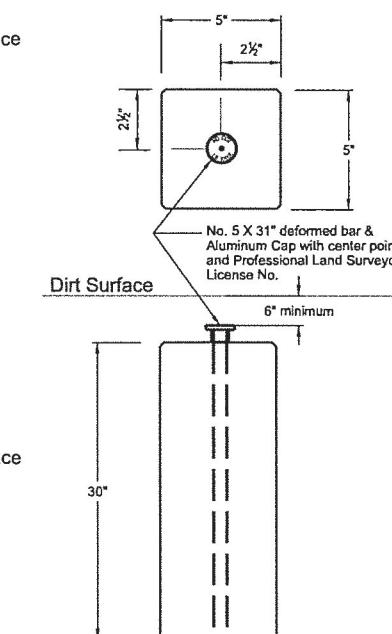
ALIGNMENT MONUMENT DETAILS



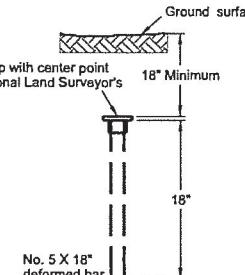
IRON PIN (Within Finished Roadway Surface)



IRON PIN (Within Finished Roadway)



**PRECAST CONCRETE
side Finished Roadway Su
(Inside R/W Limits)**



IRON PIN
nished Roadway Surface)
outside R/W Limits)

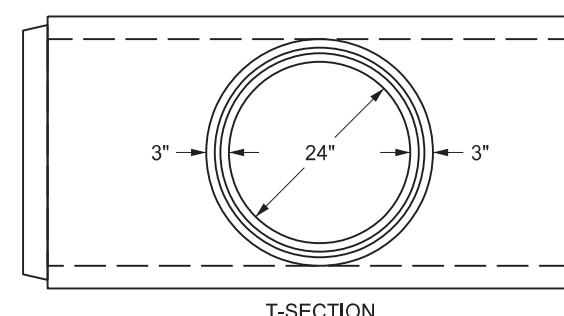
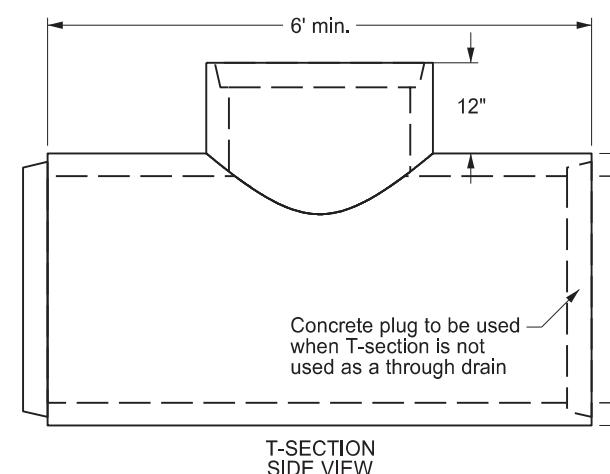
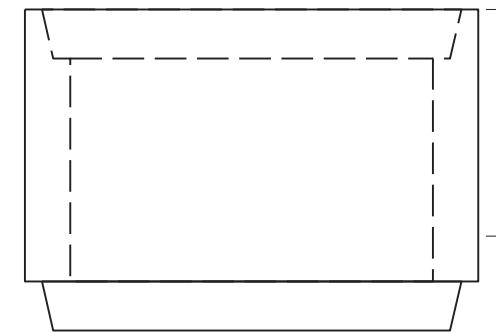
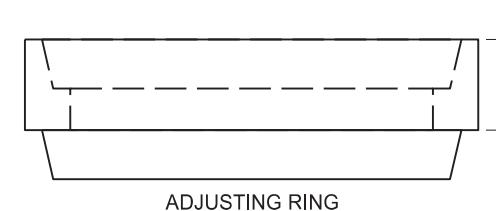
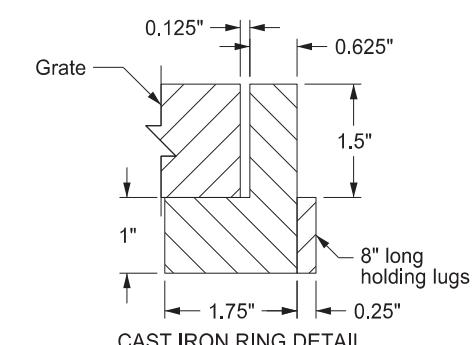
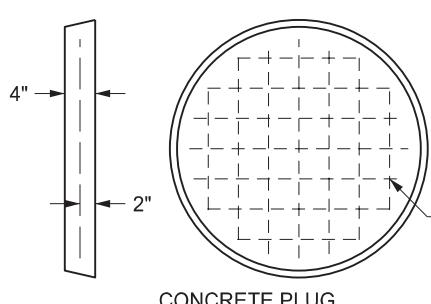
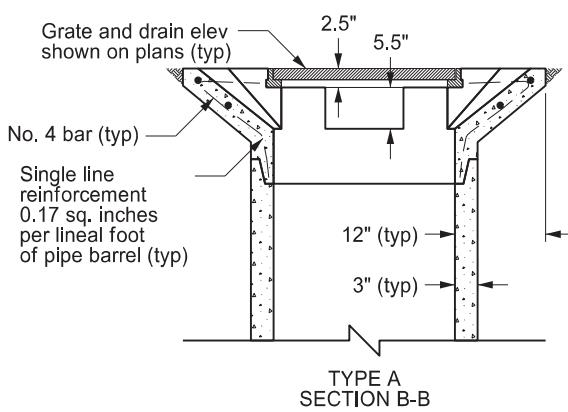
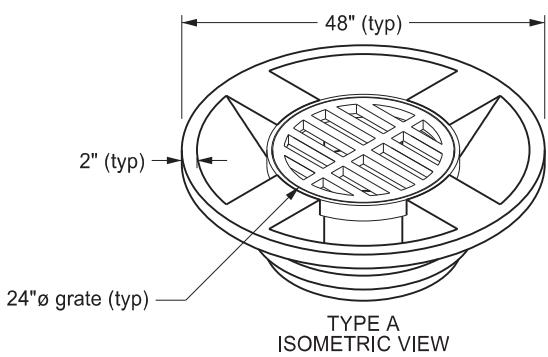
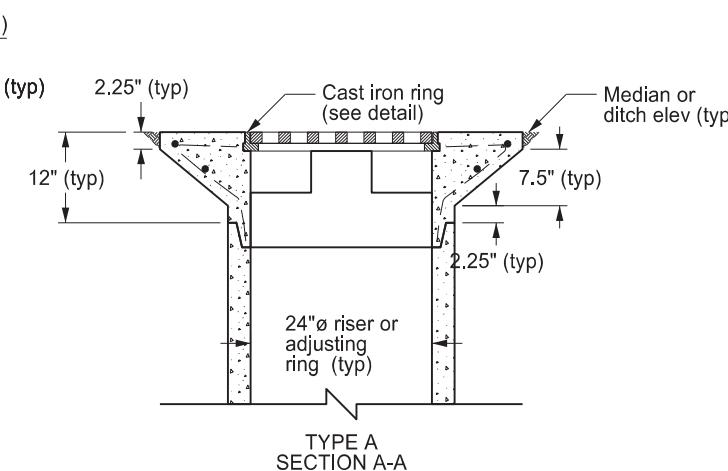
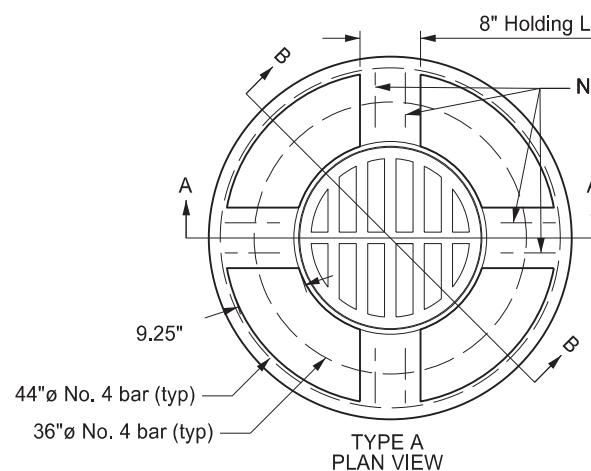
The diagram illustrates a section of a divided highway. The Right-of-Way (R/W) Line is represented by a series of horizontal dashed lines. The Section Line is a vertical dashed line that bisects the highway. Section markers are placed along the R/W Line. A circular inset shows the relationship between the R/W Line, Section Line, and Section corner. The inset shows a 90° angle between the R/W Line and Section Line, and a 90° angle at the Section corner. The inset also shows 45° angles relative to the R/W Line. The text 'Quarter sec cor Hwy & Sec line' is present in the inset. The 'Finished road surface' is indicated by a shaded area.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-2013	
REVISIONS	
DATE	CHANGE
11/12/13	Note for SIGN DETAIL modified to meet ASTM D-4956 Type III or higher on 80 gauge 5022-H38
10/17/17	Updated to active voice.
08/27/19	New Design Engr PE Stamp.



PRECAST CONCRETE MEDIAN DRAIN

D-722-7



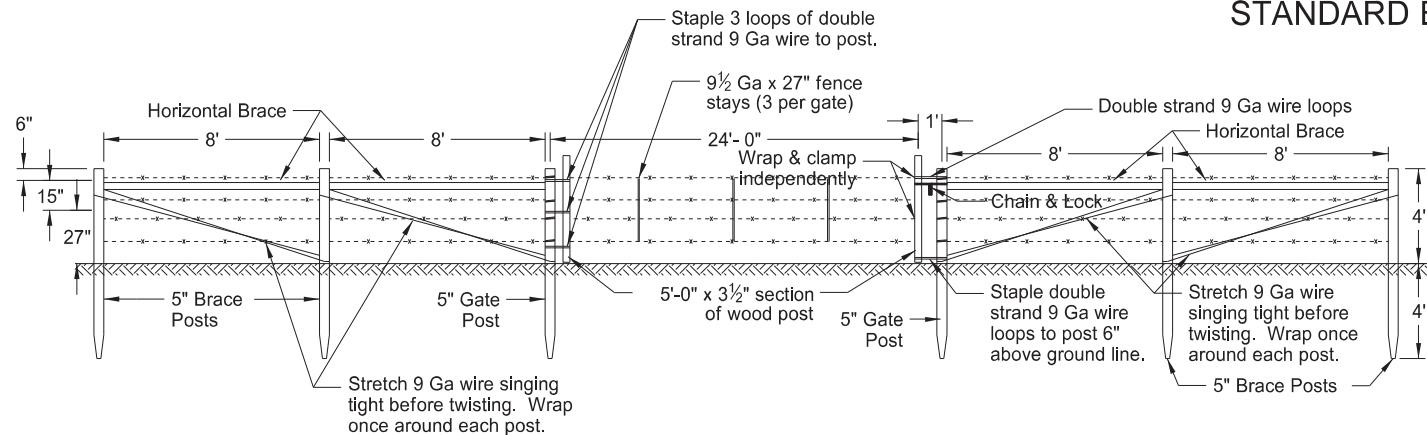
Notes:

1. Use Neenah R-4370-23G, East Jordan 1117 grate, or equal with a minimum waterway of 0.85 SF. If modifications to the drain are required to facilitate similar castings, obtain written approval from the Engineer.
2. Use castings manufactured in accordance with AASHTO M 306. Use castings comprised of metal that conforms to AASHTO M 105, Class 35B.
3. Use precast concrete median drains, adjusting rings, and riser sections that have been constructed in accordance with AASHTO M 199. Use T-sections constructed in accordance with AASHTO M 170.
4. Use only Grade 60 reinforcing steel. For adjusting rings, riser sections, and T-sections, use reinforcing that meets AASHTO M 170.
5. Include the cost of furnishing and installing the castings and drains in the price bid for "Median Drain Precast Concrete-Type A". Include the cost of furnishing and installing the adjusting rings and riser sections shall in the price bid for "Pipe Conc Reinf 24IN (CL _)" . Include the cost of furnishing and installing the T-sections and concrete plugs in the price bid for "Pipe Conc Reinf (_ IN) (CL _)" .
6. Seal all joints with rubber gaskets or with sealer approved by the engineer.

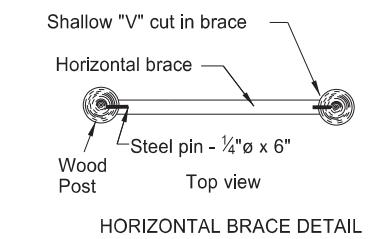
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
6-30-14	
REVISIONS	
DATE	CHANGE
8-6-21	Notes 1-5



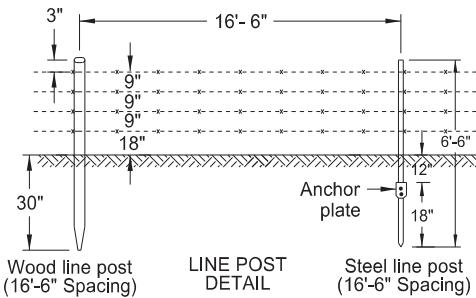
STANDARD BARBED WIRE FENCE



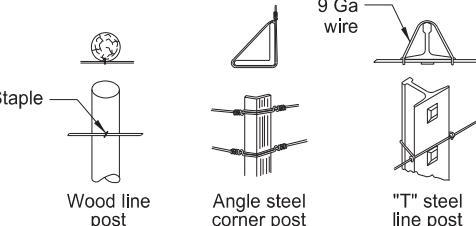
VEHICLE GATE



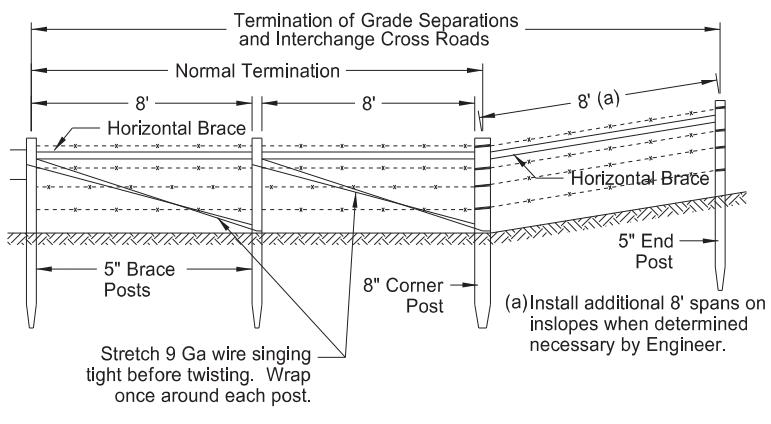
HORIZONTAL BRACE DETAIL



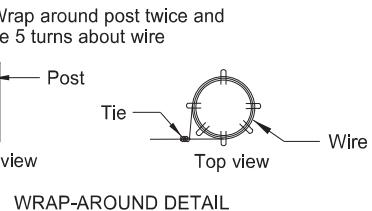
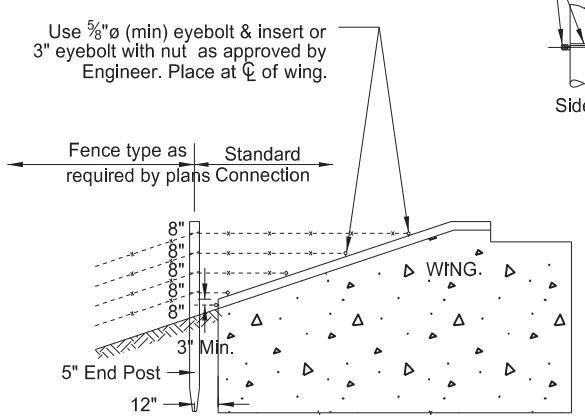
LINE POST DETAIL



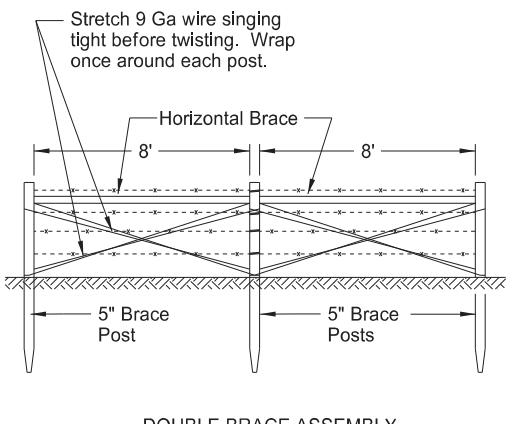
FASTENING TO POSTS



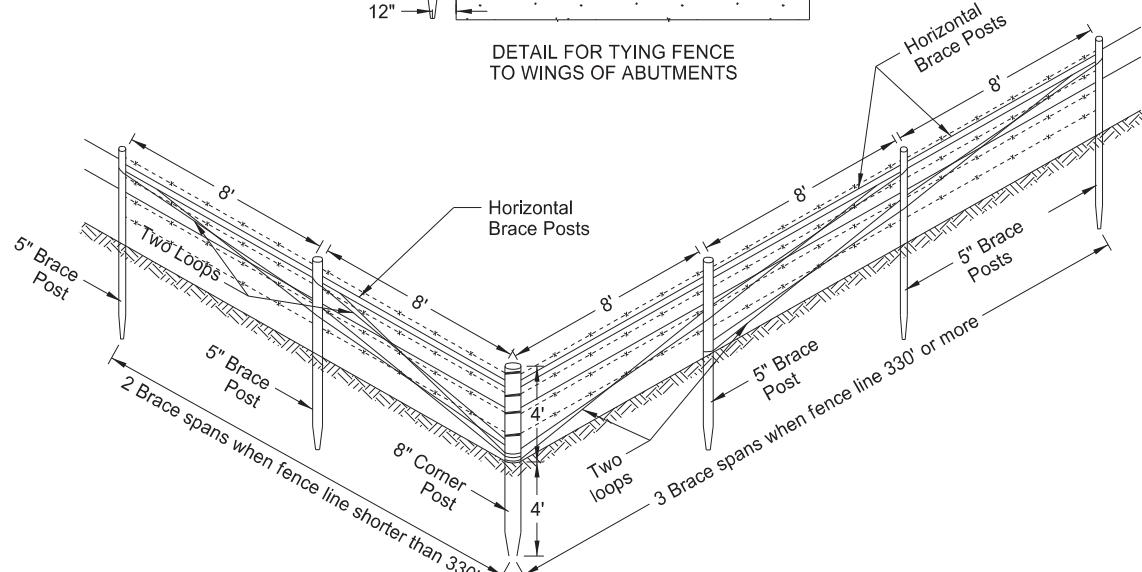
FENCE TERMINAL



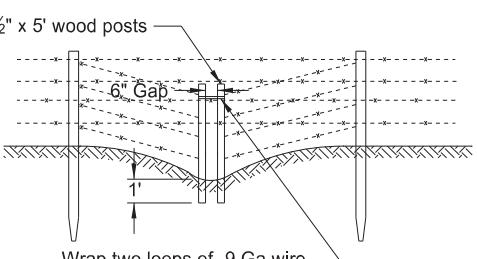
WRAP-AROUND DETAIL



DOUBLE BRACE ASSEMBLY



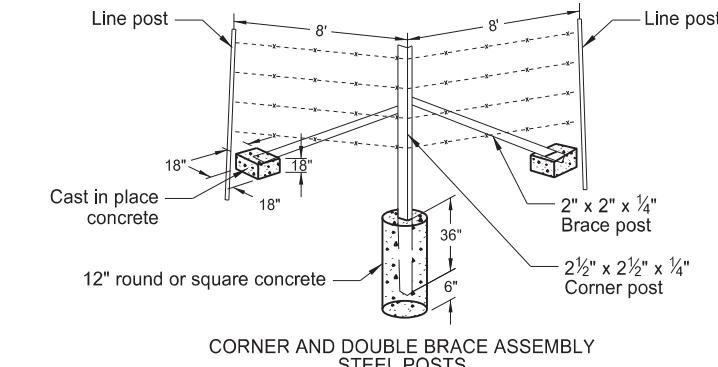
CORNER ASSEMBLY



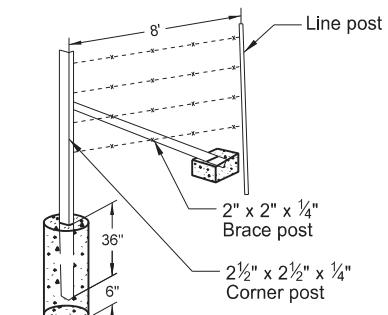
BREAK-AWAY FENCE FOR NARROW DEPRESSIONS SUBJECT TO FLOODING

DETAIL FOR ANCHORING FENCES IN DEPRESSIONS*

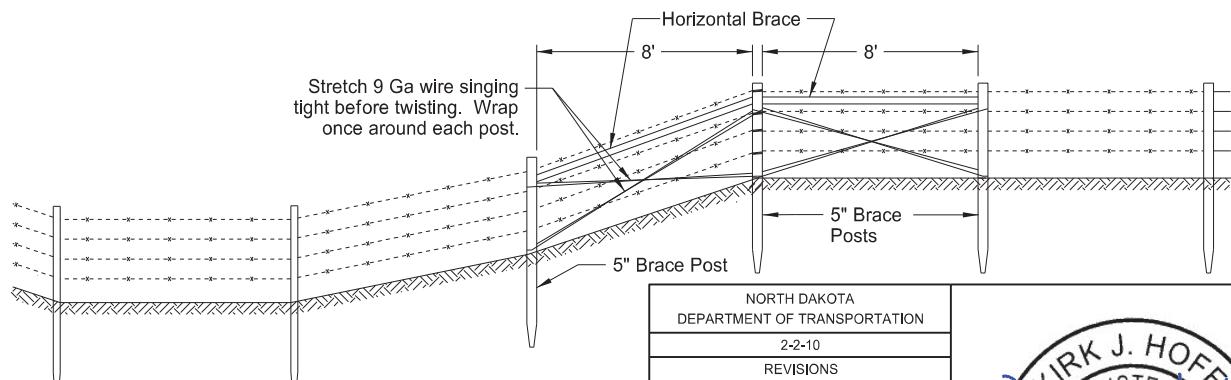
*Determine locations in the field and include in price bid for fencing. Use other methods of anchoring fence if approved by the Engineer.



CORNER AND DOUBLE BRACE ASSEMBLY STEEL POSTS



FENCE TERMINAL STEEL POSTS



FENCING FOR WIDE DEPRESSIONS

Use double brace installation, as shown, on opposite side of depression. Decrease line post spacing as needed due to terrain.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
2-2-10	
REVISIONS	
DATE	CHANGE
10-02-12 11-25-13 10-17-17 02-23-23	Notes, steel assemblies/posts. Revised Vehicle Gate. Updated to active voice. Revised post spacing/brace size.



NOTES

- No deduction in measured pay length of fence made for gates, corner assemblies, double brace assemblies, fence terminals, or depression fencing. Include all costs for abutment fencing in the price bid for fencing bid items.
- Install double brace assemblies at locations shown on the plans or established by the Engineer. Place adjacent fence terminals, corner assemblies, or double brace assemblies at a maximum spacing of 1,320 feet.
- Include all costs of furnishing and installing inserts and eyebolts in the unit price bid for fencing bid items. Use eyebolts galvanized according to AASHTO designation M-30; inserts of corrosion resistant material do not require galvanization. Use concrete inserts capable of developing the full strength of the $\frac{5}{8}$ " diameter threaded eyebolt, when installed in concrete.
- Determine post type used, either wood or steel, unless otherwise specified in the plans.
- Include the cost of bracing at vehicle gates in the price bid for "Vehicle Gate."

PIPE OR W-SHAPE ASSEMBLY DETAILS

D-754-1

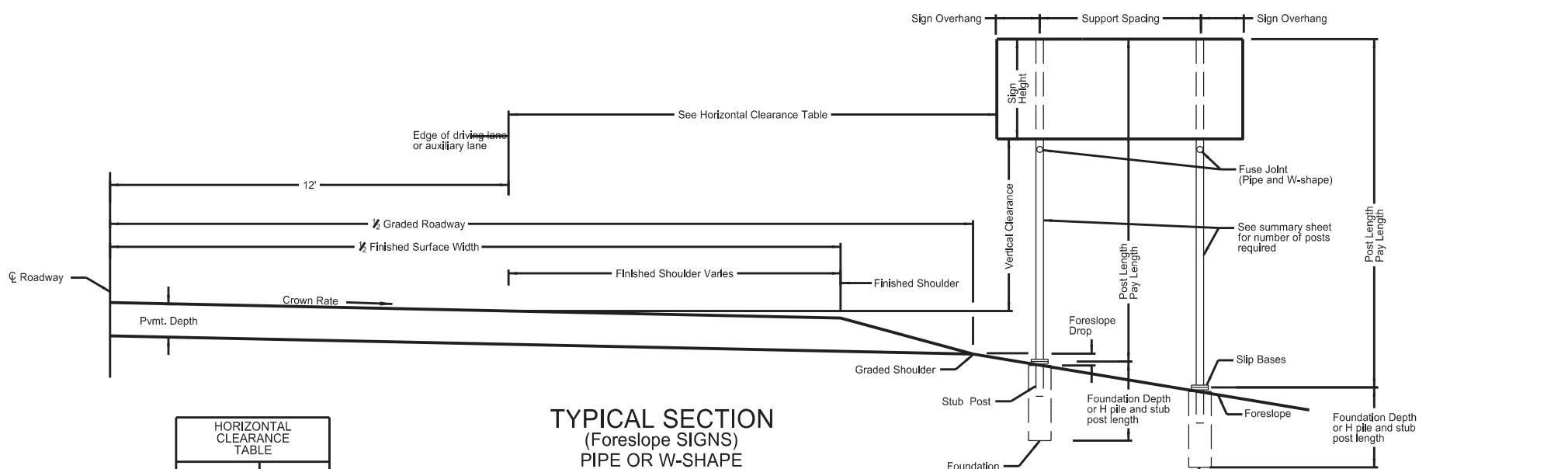
NOTES:

MINIMUM VERTICAL CLEARANCE:

Install signs with a minimum 5 foot vertical clearance from bottom of sign to top edge of the driving lane or auxiliary lane in rural locations. Provide a minimum 7 foot vertical clearance where parking or pedestrian movements occur. Install signs with a minimum 7 foot vertical clearance on freeways, expressways, and multi-lane conventional roadways.

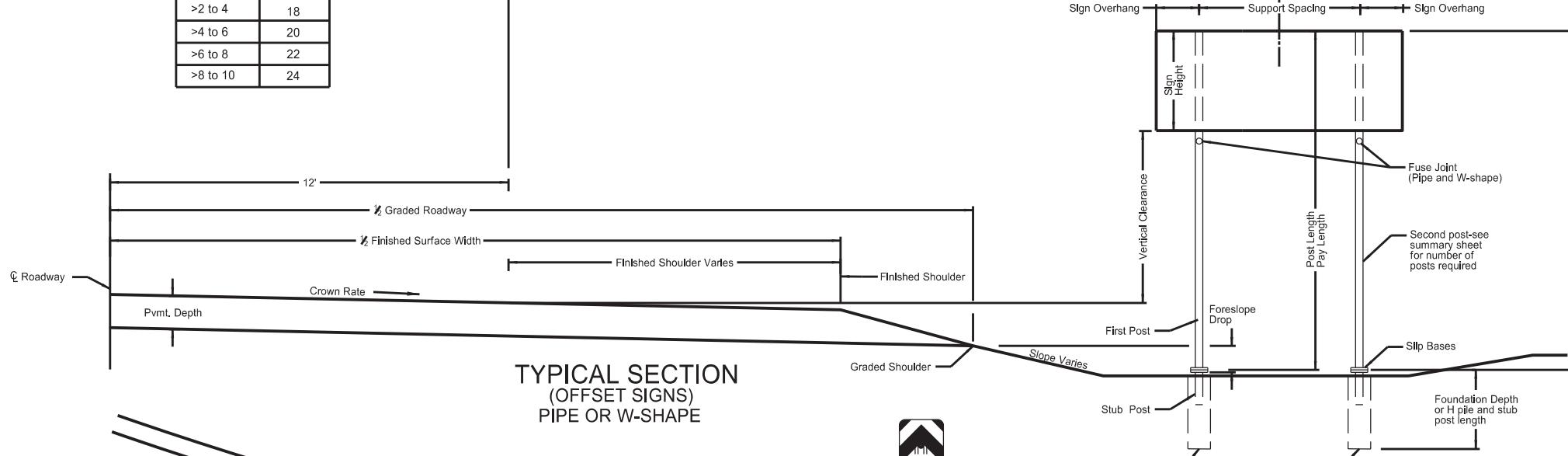
A vertical clearance of 5 feet is acceptable where signs are placed a minimum of 30 feet from the edge of the traveled way.

Place signs a maximum of 6" above the vertical clearance specified above.

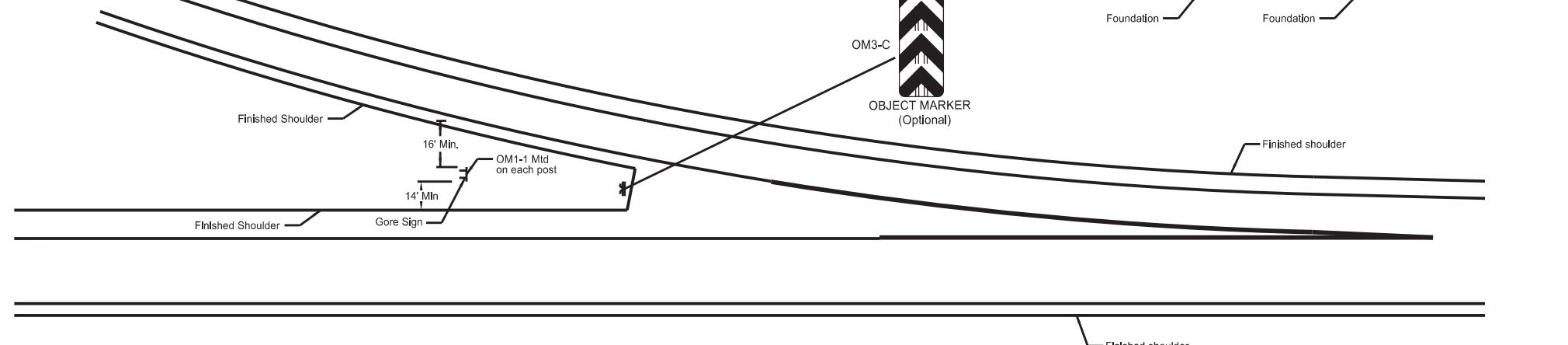


TYPICAL SECTION
(Foreslope SIGNS)
PIPE OR W-SHAPE

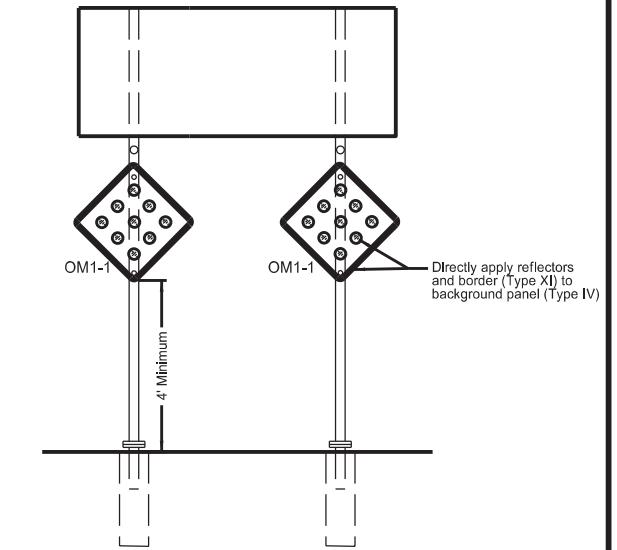
HORIZONTAL CLEARANCE TABLE	
SHOULDER WIDTH ft	OFFSET ft
0 to 2	16
>2 to 4	18
>4 to 6	20
>6 to 8	22
>8 to 10	24



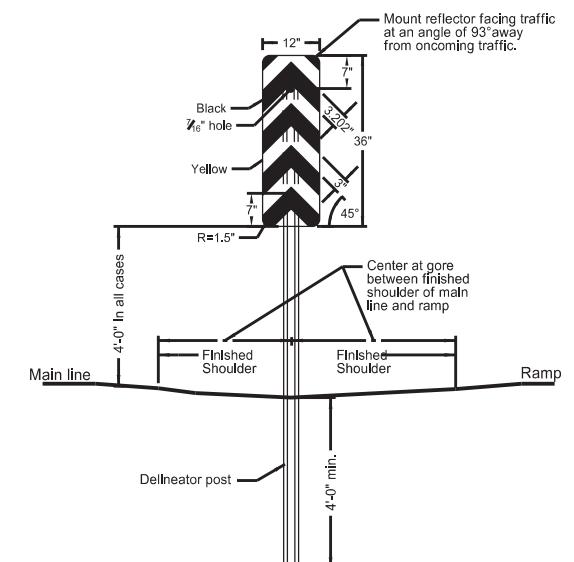
TYPICAL SECTION
(OFFSET SIGNS)
PIPE OR W-SHAPE



EXIT RAMP
GORE SIGN PLACEMENT



GORE SIGN OBJECT MARKER INSTALLATION



OBJECT MARKER INSTALLATION

NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

12-1-10

REVISIONS

DATE CHANGE

7-18-14 Modify notes and update reflective sheeting for object marker. Add correct section number for object marker post.

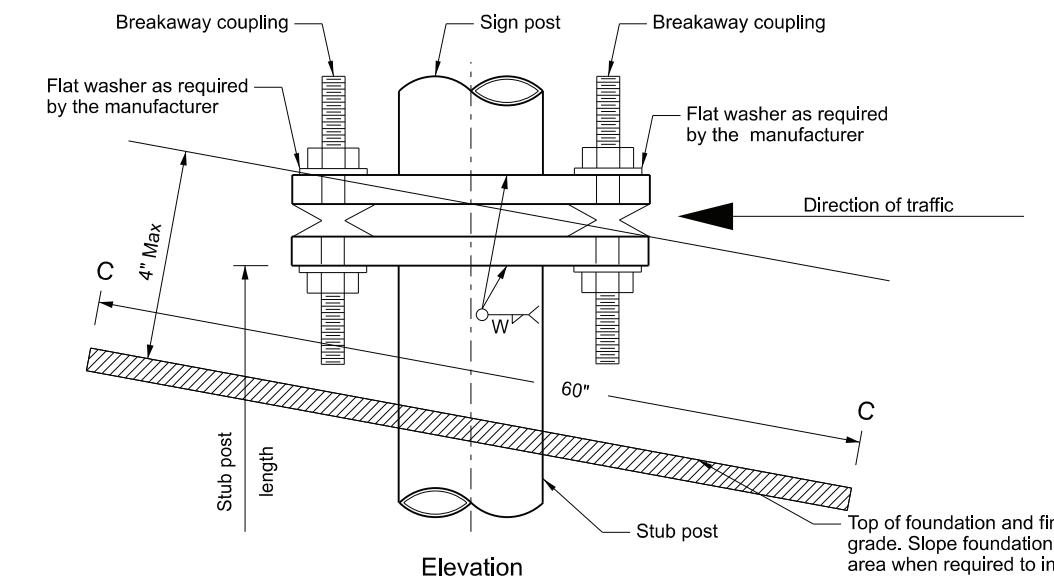
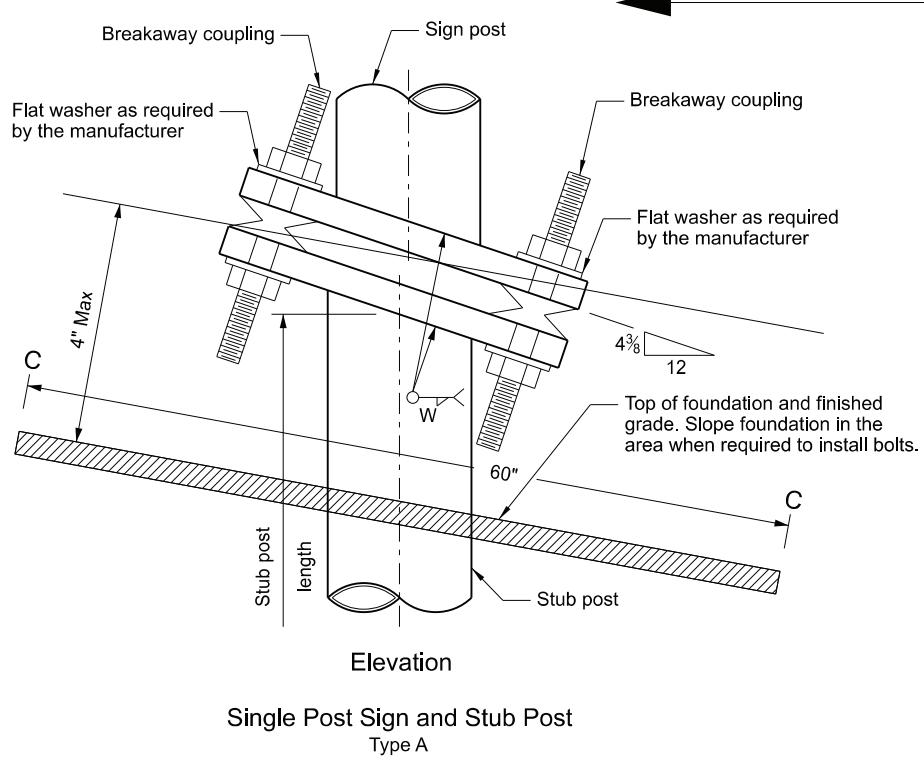
8-30-18 11-26-21 Updated notes to active voice. Revised Object Marker signs.



11/26/21

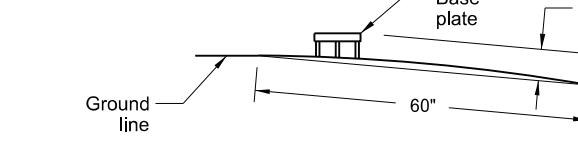
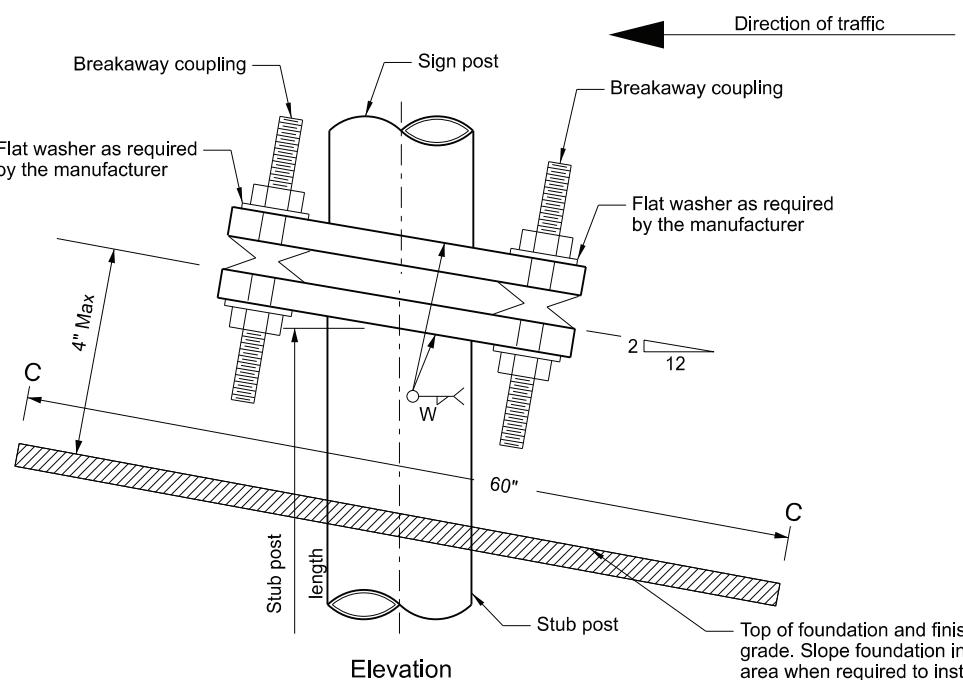
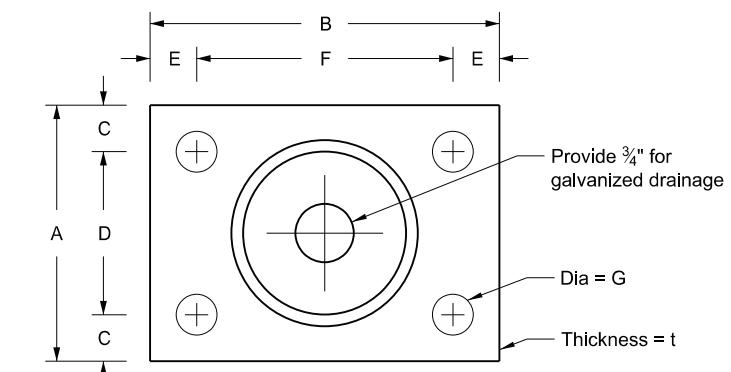
Breakaway Coupler System for Standard Pipe Stub Post

D-754-2



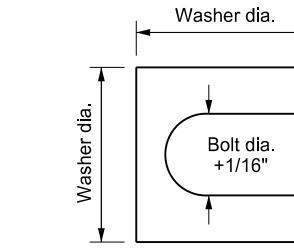
Notes:

1. In lieu of the breakaway base system on standards D-754-3 and D-754-4, use a breakaway coupler system. Manufacture the breakaway coupler system from material meeting the requirements of ASTM A325 fasteners with the special requirements as specified by DENT BREAKAWAY IND., INC. which meets the requirements of NCHRP Report 350.
2. Fuse Joint Cuts - For steel posts cut after galvanizing, either galvanize cut after fabrication, or treat cut surface in accordance with ASTM A780. Aluminum posts need no treatment.
3. Shim as required to plumb post.
4. Tighten all bolts the maximum possible with 12" to 15" wrench.



Max. protection of the stub post is 4" above a 60" chord aligned radially to the center line of the highway and connecting any point, within the length of the chord, on the ground surface on one side of the support to a point in the ground surface on the other side.

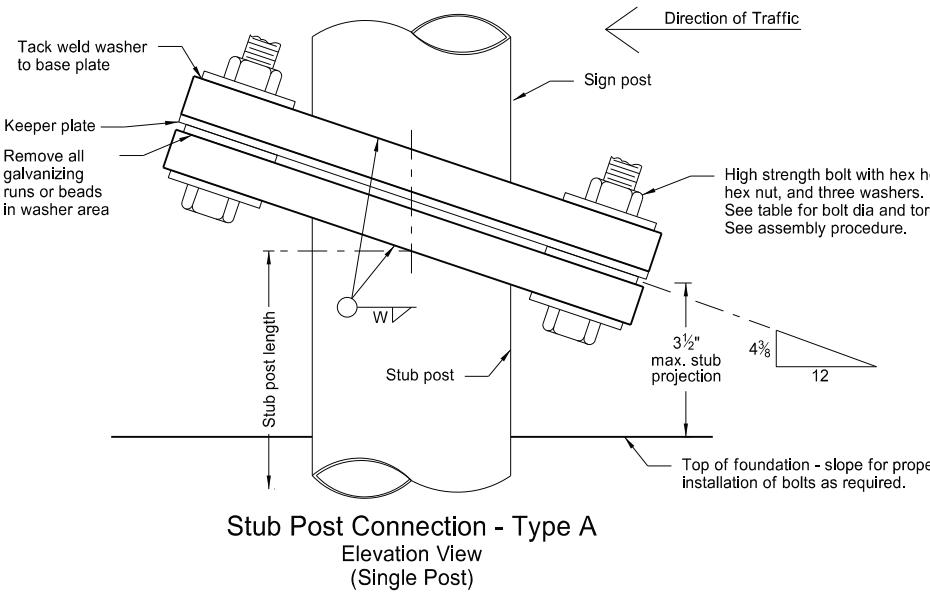
Dimension Nom. Pipe Size	Base Table Data										
	Breakaway Coupling	A	B	C	D	E	F	G	t	W	Stub Post Length
3 1/2"	1/2" x 4 1/2"	5 1/2"	8 3/8"	13 1/16"	3 7/8"	13 1/16"	6 3/4"	9/16"	3/4"	3/8"	1'-6"
4"	5/8" x 4 1/2"	5 1/2"	8 3/4"	1"	3 1/2"	1"	6 3/4"	11/16"	3/4"	3/8"	1'-6"
5"	3/4" x 5 1/4"	6 1/2"	10"	1 1/8"	4 1/4"	1 1/8"	7 3/4"	13/16"	1"	7/16"	2'-0"
6"	1" x 5 1/4"	7 1/2"	11 3/4"	1 3/8"	4 3/4"	1 3/8"	9"	1 1/16"	1 1/4"	7/16"	2'-0"
8"	1" x 5 1/4"	9 1/2"	13 1/4"	1 3/8"	6 3/4"	1 3/8"	10 1/2"	1 1/16"	1 1/4"	7/16"	2'-6"
10"	1" x 5 1/4"	11 3/4"	15 1/4"	1 3/8"	9"	1 3/8"	12 1/2"	1 1/16"	1 1/4"	1/2"	3'-0"
12"	1" x 7"	13 3/4"	18"	1 5/8"	10 1/2"	1 5/8"	14 3/4"	1 1/16"	1 1/2"	1/2"	3'-0"
Steel											
3 1/2"	1/2" x 4 1/2"	5 1/2"	8 3/8"	13 1/16"	3 7/8"	13 1/16"	6 3/4"	9/16"	3/4"	3/8"	1'-6"
4"	5/8" x 4 1/2"	5 1/2"	8 3/4"	1"	3 1/2"	1"	6 3/4"	11/16"	1"	7/16"	1'-6"
5"	3/4" x 5 1/4"	6 1/2"	10"	1 1/8"	4 1/4"	1 1/8"	7 3/4"	13/16"	1"	7/16"	2'-0"
6"	1" x 5 1/4"	7 1/2"	11 3/4"	1 3/8"	4 3/4"	1 3/8"	9"	1 1/16"	1 1/4"	7/16"	2'-0"
8"	1" x 5 1/4"	9 1/2"	13 1/4"	1 3/8"	6 3/4"	1 3/8"	10 1/2"	1 1/16"	1 1/4"	7/16"	2'-6"
10"	1" x 5 1/4"	11 3/4"	15 1/4"	1 3/8"	9"	1 3/8"	12 1/2"	1 1/16"	1 1/2"	7/16"	3'-0"
12"	1" x 7"	13 3/4"	18"	1 5/8"	10 1/4"	1 5/8"	14 3/4"	1 1/16"	1 3/4"	11/16"	3'-0"
Aluminum											
3 1/2"	1/2" x 4 1/2"	5 1/2"	8 3/8"	13 1/16"	3 7/8"	13 1/16"	6 3/4"	9/16"	3/4"	3/8"	1'-6"
4"	5/8" x 4 1/2"	5 1/2"	8 3/4"	1"	3 1/2"	1"	6 3/4"	11/16"	1"	7/16"	1'-6"
5"	3/4" x 5 1/4"	6 1/2"	10"	1 1/8"	4 1/4"	1 1/8"	7 3/4"	13/16"	1"	7/16"	2'-0"
6"	1" x 5 1/4"	7 1/2"	11 3/4"	1 3/8"	4 3/4"	1 3/8"	9"	1 1/16"	1 1/4"	7/16"	2'-0"
8"	1" x 5 1/4"	9 1/2"	13 1/4"	1 3/8"	6 3/4"	1 3/8"	10 1/2"	1 1/16"	1 1/4"	7/16"	2'-6"
10"	1" x 5 1/4"	11 3/4"	15 1/4"	1 3/8"	9"	1 3/8"	12 1/2"	1 1/16"	1 1/2"	7/16"	3'-0"
12"	1" x 7"	13 3/4"	18"	1 5/8"	10 1/4"	1 5/8"	14 3/4"	1 1/16"	1 3/4"	11/16"	3'-0"



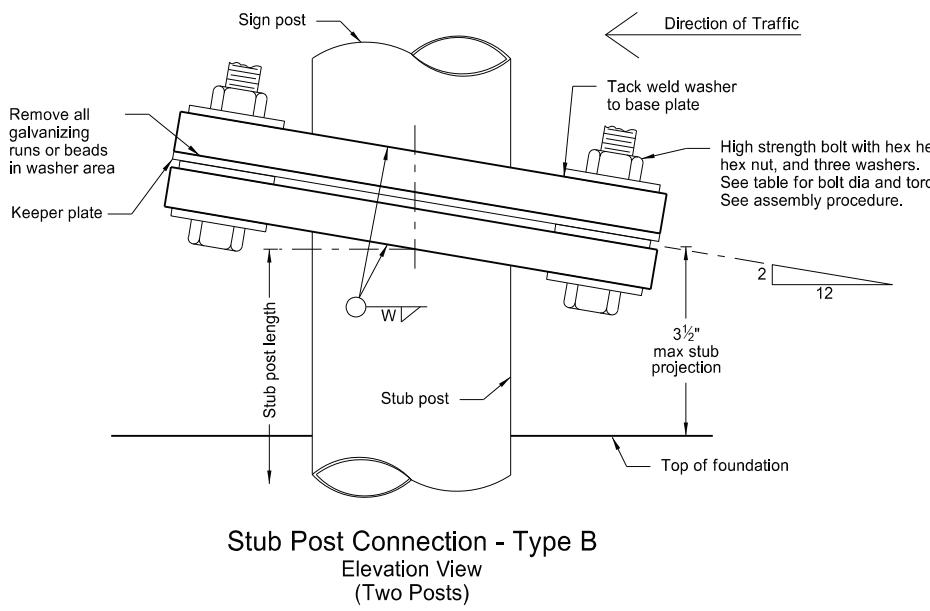
Furnish 2 - .012"± thick and 2 - .032"± thick shims per post. Fabricate shims from brass shim stock or strip conforming to ASTM B36.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-2013	
DATE	REVISIONS
8-30-2018 8-29-2019 8-05-2024	Updated notes to active voice. New Design Engineer PE Stamp. Electronic Stamp/Signature.

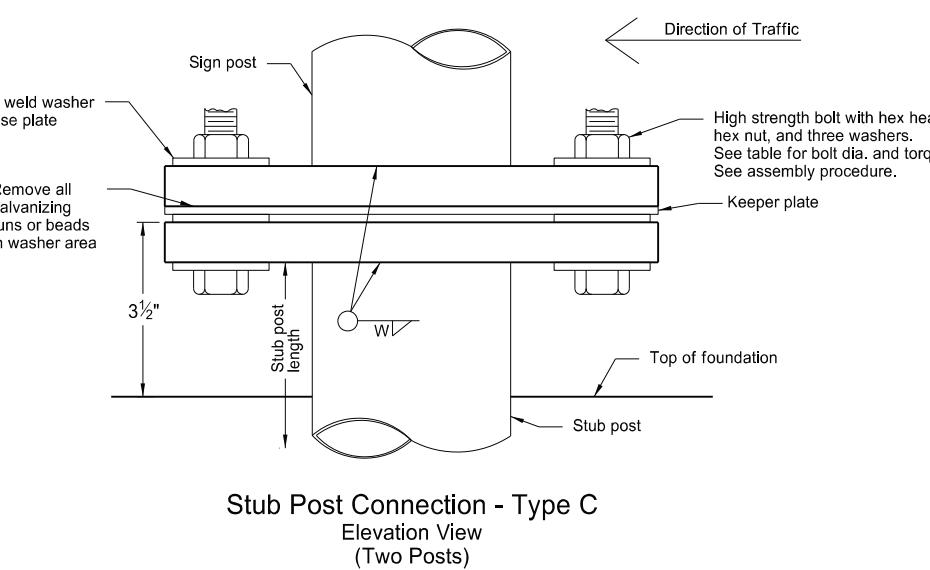




Stub Post Connection - Type A
Elevation View
(Single Post)



Stub Post Connection - Type B
Elevation View
(Two Posts)



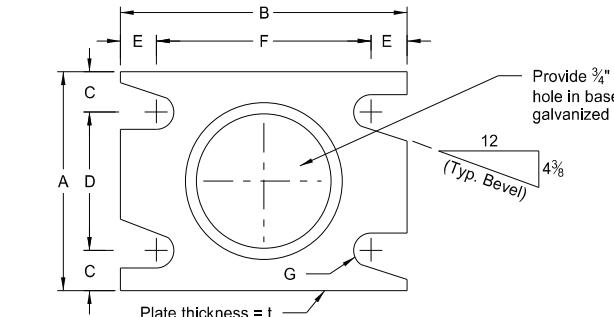
Stub Post Connection - Type C
Elevation View
(Two Posts)

Breakaway System for Standard Pipe Stub Post

Notes:
Tack weld aluminum base plate washers to the base, when the base plate is aluminum.
Use standard drawing D-754-6 for fuse plate, hinge plate, and foundation details.

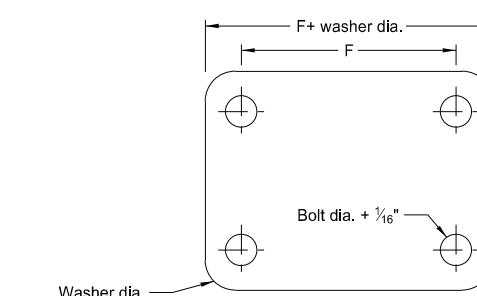
Assembly Procedure:

1. Assemble post to stub with bolts and one flat washer between base plate and keeper plate.
2. Shim as required.
3. Tighten all bolts the maximum possible with 12" to 15" wrench to bed washers and shims and to clean bolt threads, then loosen.
4. Retighten bolts in a systematic order to prescribed torque. (see table)
5. Loosen each bolt and fill the gaps between the thread and mating surface with thread locking liquid resin, conforming to ASTM D5363-03 (2008), forming solid, one part assemblies secure from vibration, pressure, and corrosion.
6. Retighten each bolt to prescribed torque in the same order as initial retightening.



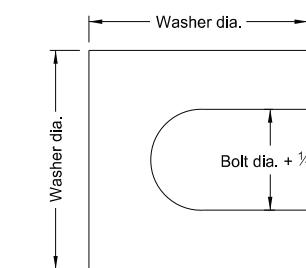
Base Plate Plan View

Place bevel toward roadway on approach side and away on the other side.



Keeper Plate Detail

Place keeper plate above center washer between top and bottom slip bases. Fabricate keeper plate from 28 gauge material and galvanize after fabrication in conformance with ASTM A653 G60 coating.



Shim Detail

Furnish 2 each ±.012" thick and 2 each ±.032" thick shims per post. Fabricate shims from brass shim stock or strip in conformance with ASTM B36.

Base Data Table												
Nominal Post Size dia.	Bolt Size (dia. x length)	Base Bolt Torque ft. lb.	A	B	C	D	E	F	G	t	W	Stub Post Length
Steel												
3 1/2"	1/2"x2 1/2"	12	5 1/2"	8 3/8"	13 1/16"	3 7/8"	13 1/16"	6 3/4"	9/32"	3/4"	3/8"	1'-6"
4"	5/8"x2 3/4"	29	5 1/2"	8 3/4"	1"	3 1/2"	1"	6 3/4"	1 1/32"	3/4"	3/8"	1'-6"
5"	3/4"x3 1/2"	46	6 1/2"	10"	1 1/8"	4 1/4"	1 1/8"	7 3/4"	13 3/32"	1"	7/16"	2'-0"
6"	1"x4 1/4"	61	7 1/2"	11 3/4"	1 3/8"	4 3/4"	1 3/8"	9"	17/32"	1 1/4"	7/16"	2'-0"
Aluminum												
3 1/2"	1/2"x2 1/2"	12	5 1/2"	8 3/8"	13 1/16"	3 7/8"	13 1/16"	6 3/4"	9/32"	3/4"	3/8"	1'-6"
4"	5/8"x2 3/4"	29	5 1/2"	8 3/4"	1"	3 1/2"	1"	6 3/4"	1 1/32"	1"	7/16"	1'-6"
5"	3/4"x3 1/2"	46	6 1/2"	10"	1 1/8"	4 1/4"	1 1/8"	7 3/4"	13 3/32"	1"	1/2"	2'-0"
6"	1"x4 1/4"	61	7 1/2"	11 3/4"	1 3/8"	4 3/4"	1 3/8"	9"	17/32"	1 1/4"	1/2"	2'-0"

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-21-11	
REVISIONS	
DATE	CHANGE
2-28-14	Removed lower post and foundation details.
8-30-18	Updated notes to active voice.
8-29-19	New Design Engineer PE Stamp.
8-05-24	Electronic Stamp/Signature.



FOUNDATION DATA FOR STEEL SUPPORTS

D-754-5

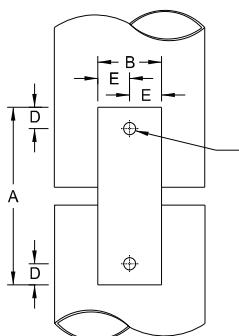
Foundation Diameter	Foundation			Vertical Reinforcing Steel			Horizontal Tie Bars			
	Depth	Conc. Vol. for 1 Post (CU YDS)	Conc. Vol. for 2 Posts (CU YDS)	Length of Each Bar	Size	No. Bars for 1 Post	No. Bars for 2 Posts	Size	No. Bars for 1 Post	No. Bars for 2 Posts
1'- 4"	4'- 6"	0.23	0.47	4'- 2"	5	6	12	3	6	12
1'- 4"	5'- 0"	0.26	0.52	4'- 8"	5	6	12	3	7	14
1'- 4"	5'- 6"	0.28	0.57	5'- 2"	5	6	12	3	8	16
1'- 4"	6'- 0"	0.31	0.62	5'- 8"	5	6	12	3	8	16
1'- 4"	6'- 6"	0.34	0.67	6'- 2"	5	6	12	3	9	18
1'- 4"	7'- 0"	0.36	0.72	6'- 8"	5	6	12	3	9	18
1'- 4"	7'- 6"	0.39	0.78	7'- 2"	5	6	12	3	10	20
1'- 4"	8'- 0"	0.41	0.83	7'- 8"	5	6	12	3	11	22
1'- 4"	8'- 6"	0.44	0.88	8'- 2"	5	6	12	3	11	22
1'- 4"	9'- 0"	0.47	0.93	8'- 8"	5	6	12	3	12	24
1'- 4"	9'- 6"	0.49	0.98	9'- 2"	5	6	12	3	12	24
1'- 4"	10'- 0"	0.52	1.03	9'- 8"	5	6	12	3	13	26
1'- 4"	10'- 6"	0.54	1.09	10'- 2"	5	6	12	3	14	28
1'- 4"	11'- 0"	0.57	1.14	10'- 8"	5	6	12	3	14	28
1'- 4"	11'- 6"	0.59	1.19	11'- 2"	5	6	12	3	15	30
1'- 4"	12'- 0"	0.62	1.24	11'- 8"	5	6	12	3	15	30

Foundation Diameter	Foundation			Vertical Reinforcing Steel			Horizontal Tie Bars			
	Depth	Conc. Vol. for 1 Post (CU YDS)	Conc. Vol. for 2 Posts (CU YDS)	Length of Each Bar	Size	No. Bars for 1 Post	No. Bars for 2 Posts	Size	No. Bars for 1 Post	No. Bars for 2 Posts
1'- 9"	4'- 6"	0.40	0.80	4'- 2"	5	10	20	3	6	12
1'- 9"	5'- 0"	0.45	0.89	4'- 8"	5	10	20	3	7	14
1'- 9"	5'- 6"	0.49	0.98	5'- 2"	5	10	20	3	8	16
1'- 9"	6'- 0"	0.53	1.07	5'- 8"	5	10	20	3	8	16
1'- 9"	6'- 6"	0.58	1.16	6'- 2"	5	10	20	3	9	18
1'- 9"	7'- 0"	0.62	1.25	6'- 8"	5	10	20	3	9	18
1'- 9"	7'- 6"	0.67	1.34	7'- 2"	5	10	20	3	10	20
1'- 9"	8'- 0"	0.71	1.43	7'- 8"	5	10	20	3	11	22
1'- 9"	8'- 6"	0.76	1.51	8'- 2"	5	10	20	3	11	22
1'- 9"	9'- 0"	0.80	1.60	8'- 8"	5	10	20	3	12	24
1'- 9"	9'- 6"	0.85	1.69	9'- 2"	5	10	20	3	12	24
1'- 9"	10'- 0"	0.89	1.78	9'- 8"	5	10	20	3	13	26
1'- 9"	10'- 6"	0.94	1.87	10'- 2"	5	10	20	3	14	28
1'- 9"	11'- 0"	0.98	1.96	10'- 8"	5	10	20	3	14	28
1'- 9"	11'- 6"	1.02	2.05	11'- 2"	5	10	20	3	15	30
1'- 9"	12'- 0"	1.07	2.14	11'- 8"	5	10	20	3	15	30

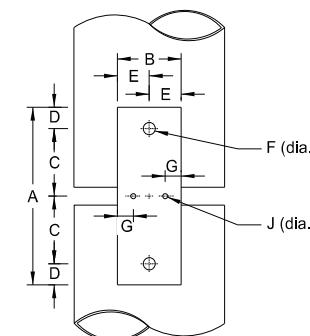
Foundation Diameter	Foundation			Vertical Reinforcing Steel			Horizontal Tie Bars			
	Depth	Conc. Vol. for 1 Post (CU YDS)	Conc. Vol. for 2 Posts (CU YDS)	Length of Each Bar	Size	No. Bars for 1 Post	No. Bars for 2 Posts	Size	No. Bars for 1 Post	No. Bars for 2 Posts
2'- 0"	4'- 6"	0.52	1.05	4'- 2"	6	10	20	3	6	12
2'- 0"	5'- 0"	0.58	1.16	4'- 8"	6	10	20	3	7	14
2'- 0"	5'- 6"	0.64	1.28	5'- 2"	6	10	20	3	8	16
2'- 0"	6'- 0"	0.70	1.40	5'- 8"	6	10	20	3	8	16
2'- 0"	6'- 6"	0.76	1.51	6'- 2"	6	10	20	3	9	18
2'- 0"	7'- 0"	0.81	1.63	6'- 8"	6	10	20	3	9	18
2'- 0"	7'- 6"	0.87	1.75	7'- 2"	6	10	20	3	10	20
2'- 0"	8'- 0"	0.93	1.86	7'- 8"	6	10	20	3	11	22
2'- 0"	8'- 6"	0.99	1.98	8'- 2"	6	10	20	3	11	22
2'- 0"	9'- 0"	1.05	2.09	8'- 8"	6	10	20	3	12	24
2'- 0"	9'- 6"	1.11	2.21	9'- 2"	6	10	20	3	12	24
2'- 0"	10'- 0"	1.16	2.33	9'- 8"	6	10	20	3	13	26
2'- 0"	10'- 6"	1.22	2.44	10'- 2"	6	10	20	3	14	28
2'- 0"	11'- 0"	1.28	2.56	10'- 8"	6	10	20	3	14	28
2'- 0"	11'- 6"	1.34	2.68	11'- 2"	6	10	20	3	15	30
2'- 0"	12'- 0"	1.40	2.79	11'- 8"	6	10	20	3	15	30
2'- 0"	12'- 6"	1.45	2.91	12'- 2"	6	10	20	3	16	32
2'- 0"	13'- 0"	1.51	3.03	12'- 8"	6	10	20	3	17	34
2'- 0"	13'- 6"	1.57	3.14	13'- 2"	6	10	20	3	17	34
2'- 0"	14'- 0"	1.63	3.26	13'- 8"	6	10	20	3	18	36
2'- 0"	14'- 6"	1.69	3.37	14'- 2"	6	10	20	3	18	36
2'- 0"	15'- 0"	1.75	3.49	14'- 8"	6	10	20	3	19	38

Foundation Diameter	Foundation			Vertical Reinforcing Steel			Horizontal Tie Bars			
	Depth	Conc. Vol. for 1 Post (CU YDS)	Conc. Vol. for 2 Posts (CU YDS)	Length of Each Bar	Size	No. Bars for 1 Post	No. Bars for 2 Posts	Size	No. Bars for 1 Post	No. Bars for 2 Posts
2'- 4"	4'- 6"	0.71	1.43	4'- 2"	6	14	28	3	6	12
2'- 4"	5'- 0"	0.79	1.58	4'- 8"	6	14	28	3	7	14
2'- 4"	5'- 6"	0.87	1.74	5'- 2"	6	14	28	3	8	16

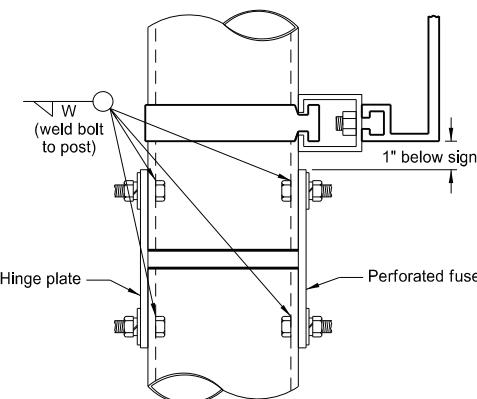
**Hinge Plate, Fuse Plate
and Foundation Details
for Standard Pipe**



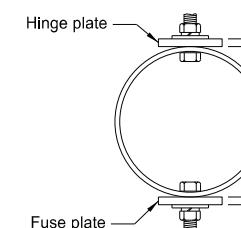
Hinge Plate



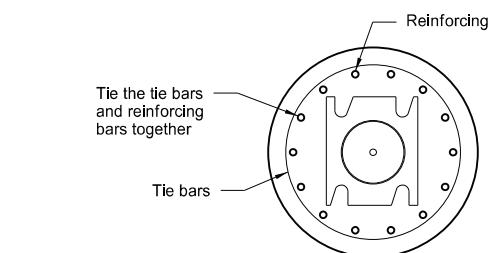
Perforated Fuse Plate



Side View

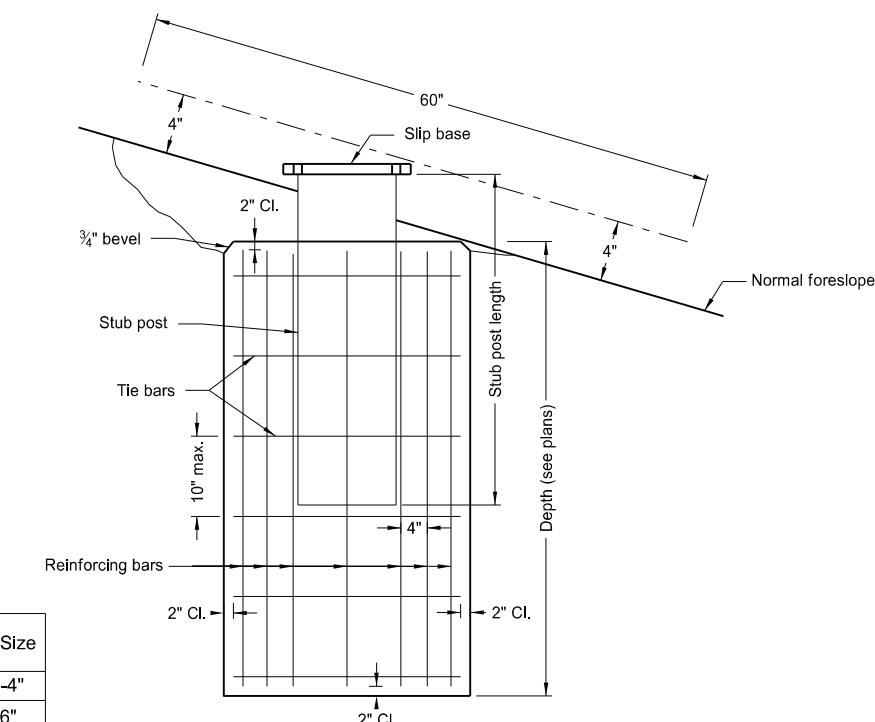


Top View



Top View

See standard drawing D-754-5 for size, number, and length of rebar. Use 3 bolt base plate for Type D.



**Foundation
Front View**

Foundation detail for breakaway base with stub post connection.

Round Metal Posts								
Dimensions				Properties				
Nominal dia. in.	Outside dia. in.	Inside dia. in.	Wall Thickness in.	Weight per Foot Pound	Moment of Inertia in. ⁴	Cross Sec. Area in. ²	Section Diameter in. ²	
Steel								
3 1/2	4.000	3.548	.226	9.11	4.788	2.680	2.394	
4	4.500	4.026	.237	10.79	7.233	3.174	3.215	
5	5.563	5.047	.258	14.62	15.16	4.300	5.449	
6	6.625	6.065	.280	18.97	28.14	5.581	8.495	
Aluminum								
3 1/2	4.000	3.548	.226	3.151	4.788	2.680	2.394	
4	4.500	4.026	.237	3.733	7.232	3.174	3.214	
5	5.563	5.047	.258	5.057	15.16	4.300	5.451	
6	6.625	6.065	.280	6.564	28.14	5.581	8.496	

Nominal Pipe Size dia.	Fuse and Hinge Plate Data										
	Bolt Size	A	B	C	D	E	F	G	H	I	J
3 1/2"	1/2"Ø x 1 1/2"	5"	1 3/4"	1 1/16"	13/16"	7/8"	9/16"	15/32"	1/4"	13/32"	7/16"
4"	5/8"Ø x 1 1/2"	5 3/4"	2"	1 7/8"	1"	1"	1 1/16"	17/32"	3/8"	15/32"	9/16"
5"	5/8"Ø x 1 3/4"	5 3/4"	2"	1 7/8"	1"	1"	1 1/16"	9/16"	1/2"	7/16"	5/8"
6"	3/4"Ø x 2 1/4"	6 1/4"	2 1/4"	2"	1 1/8"	1 1/8"	13/16"	5/8"	1/2"	1/2"	5/8"

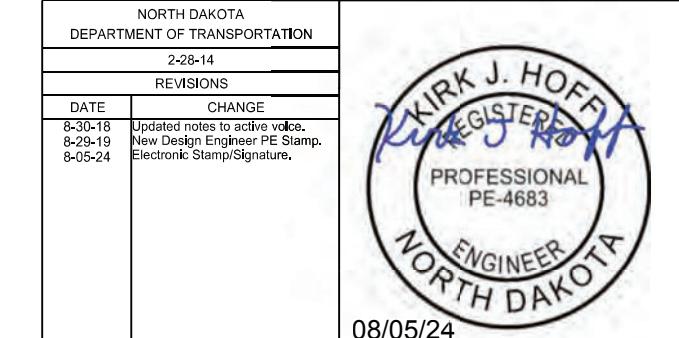
Notes:
Fuse Joint Cuts - For steel posts cut after galvanizing, either galvanize cut after fabrication, or treat cut surface in accordance with ASTM A780. Aluminum posts need no treatment.

Use standard drawings D-754-2, D-754-3 and D-754-4 for information on breakaway base details.

Maintain the 4" vertical height and 60" diameter horizontal clearance of the break-away base at each post location.

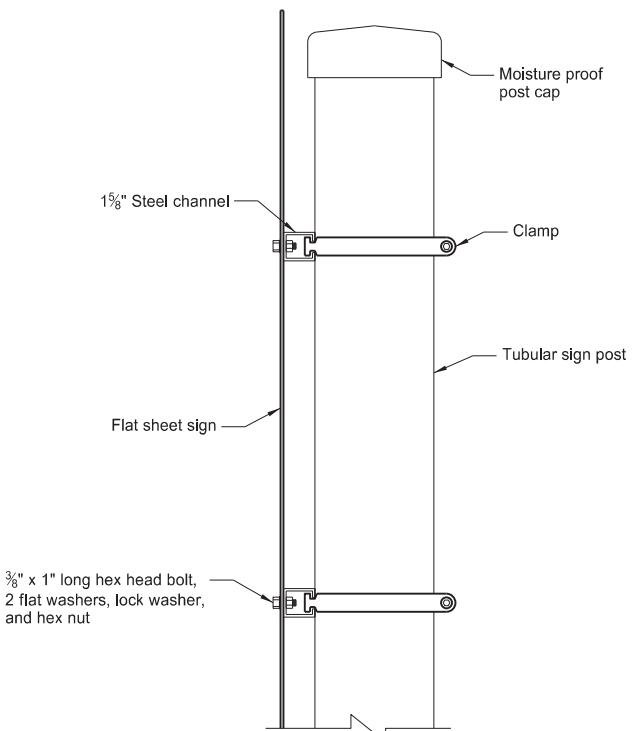
Assembly Procedure:

1. Assemble hinge plate to post with bolts and one flat washer and lock washer under nut.
2. Tighten all bolts the maximum possible with 12" to 15" wrench.

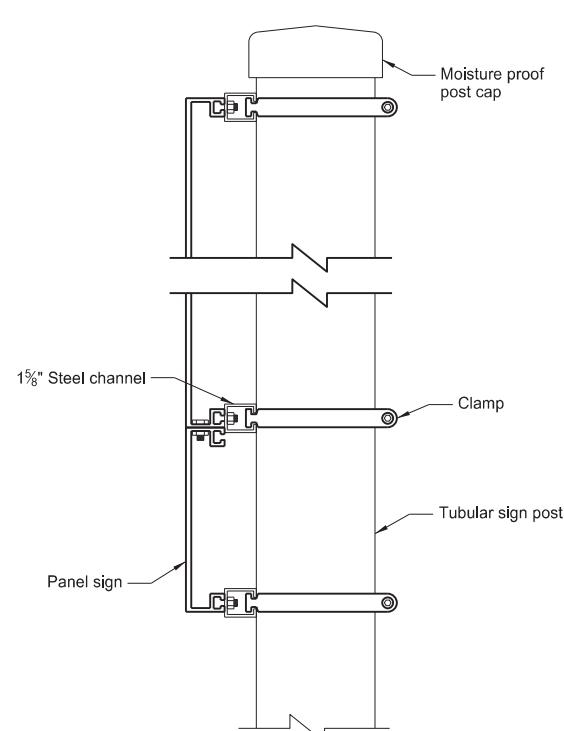


PIPE SUPPORT AND SIGN MOUNTING DETAILS

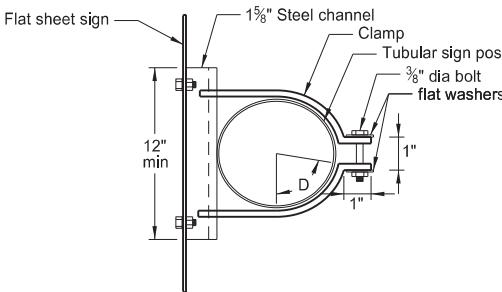
D-754-7



Side View

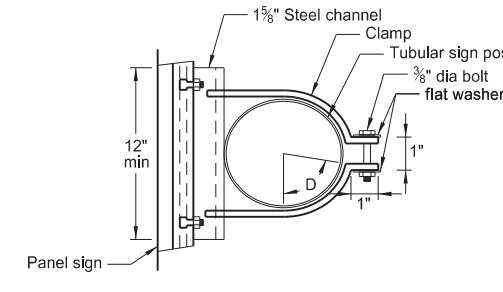


Side View



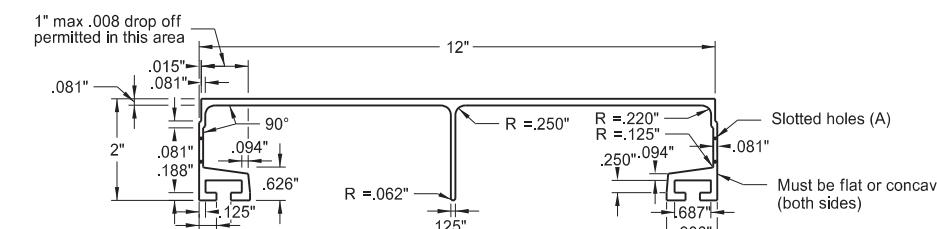
Top View

Flat Sheet Sign Clamp Mounting Details

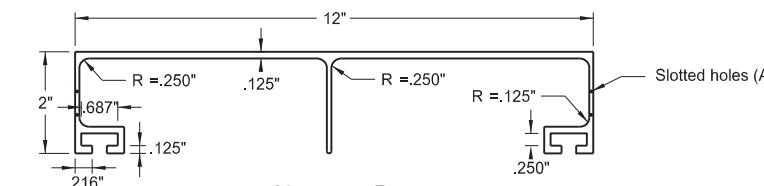


Top View

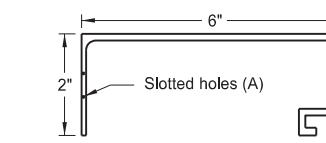
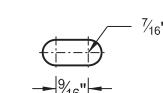
Panel Sign Clamp Mounting Details



Alternate A
12" Extruded Panel



Alternate B
12" Extruded Panel

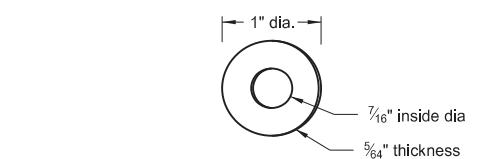


Aluminum Panel Details

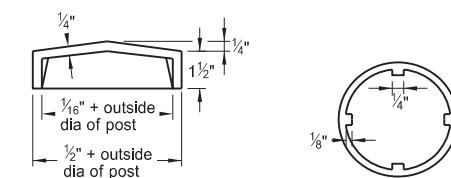
(A) Punch slotted holes in aluminum panels at 1'-0" on center, space from end as listed below:

12" even length panels 4'-0" etc.
9" odd + 6" length panels 5'-6" etc.
6" odd length panels 5'-0" etc.
3" even + 6" length panels 4'-6" etc.

Wall thickness = .078" unless specified otherwise.
All inside and outside corners = .031" radius unless specified otherwise.



Flat Washer Detail

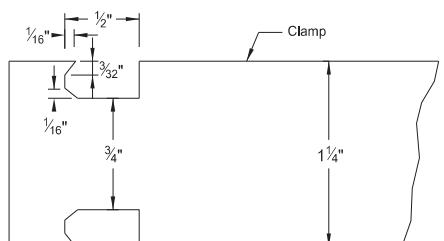


Side View

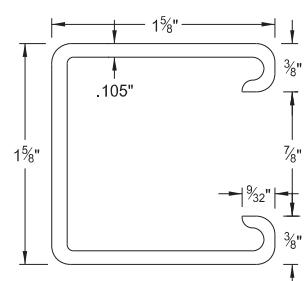
Top View

Post Cap Detail

Furnish post caps for all steel or aluminum posts or weld a 1/8" plate all around.



Clamp Detail



Steel Channel Detail

Post Size dia (in)	Clamp Gauge min
3 1/2" to 5"	11
6" to 12"	10

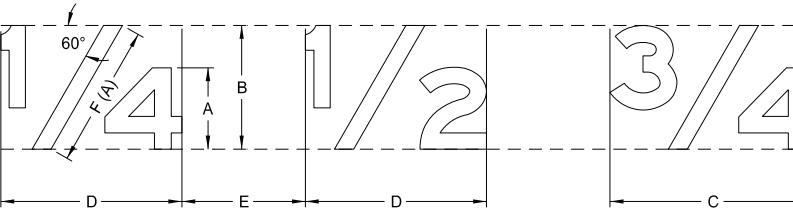
Post Size dia (in)	D (in)
3 1/2	3
4	3 3/16
5	5 1/8
6	7 7/16
8	13 1/16
10	20 3/4
12	29 5/8

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
2-21-14	
REVISIONS	
DATE	CHANGE
08-30-18 08-29-19 10-19-22	Updated to active voice, defined bolt & washer for fastening sign. New Design Engineer PE Stamp. Added washers to clamp.



LETTER AND ARROW DETAILS

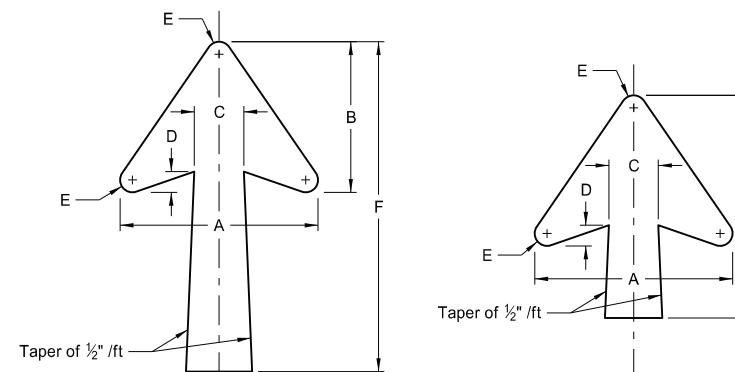
D-754-9



DETERMINE SIZE OF THE FRACTION AS FOLLOWS:

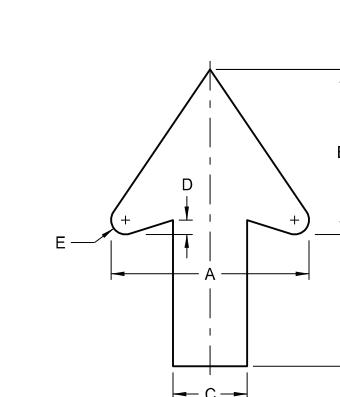
SYMBOL	TITLE	RATIO TO HEIGHT OF CAPITAL OR UPPER CASE
A	Letter height	1.0 of capital or upper case
B	Fraction height	1.5 X A
C	Fraction width	2.5 X A
D	Fraction width	2 X A
E	Space to next character	1 to 1.5 X A
F(A)	Length of diagonal	1.75 X A

(A) Center diagonal stroke of fraction optically.



TYPE A

TYPE B



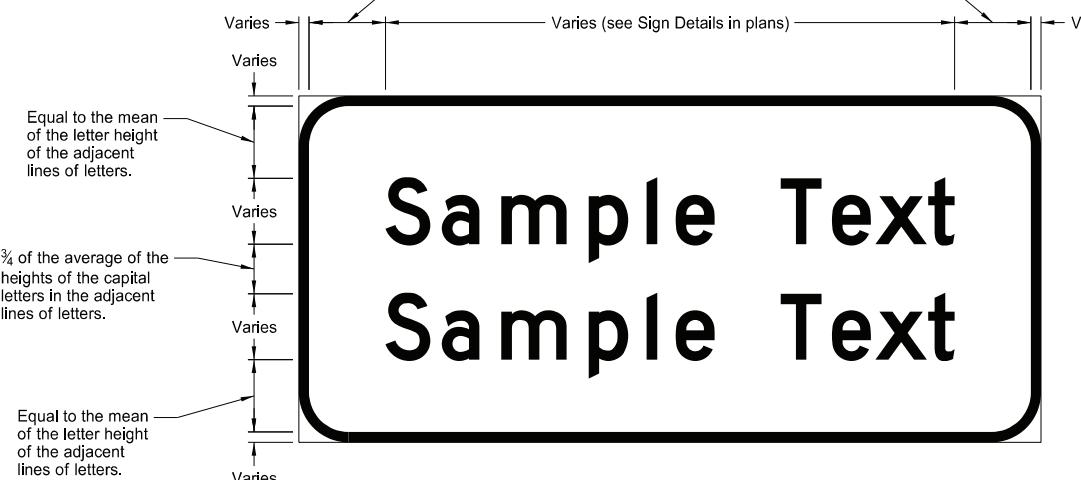
TYPE D

NOTE: Measure rotation angle of arrows counterclockwise from positions shown in details.

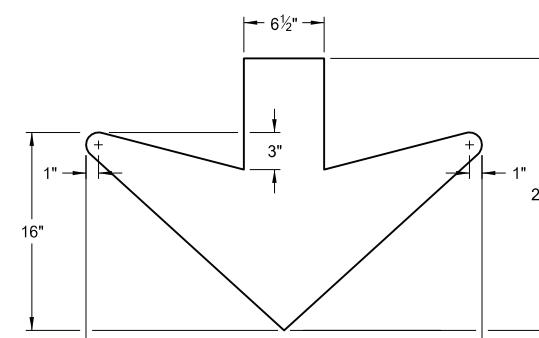
DESIGNATION	LETTER SIZE (Upper Case)	A	B	C	D	E	F	G	
ND_6IN	6"		12"	9.125"	3"	1"	0.625"	20"	13.5"
ND_8IN	8"		15.125"	11.563"	3.75"	1.313"	0.813"	25"	17"
ND_10IN	10"								
ND_12IN	12"		18.25"	14"	4.5"	1.5"	0.75"	30"	20"
ND_13IN	13.3"								
ND_16IN	16"		22.25"	17"	5.375"	1.75"	1"	35"	25"
ND_20IN	20"								

NOTE: Arrow size on gore signs is based on the letter size of "EXIT".

DESIGNATION	LETTER SIZE (Upper Case)	A	B	C	D	E	F
ND_2IN	2"		2"	1.625"	0.75"	0.125"	0.125"
ND_4IN	4"		4"	3.313"	1.5"	0.25"	0.25"
ND_6IN	6"		6"	4.875"	2.25"	0.375"	0.375"
ND_8IN	8"		8"	6.625"	3"	0.5"	0.5"
ND_10IN	10"		10"	8.375"	3.75"	0.75"	0.75"
ND_12IN	12"		12"	10"	4.5"	0.875"	0.875"
							18"

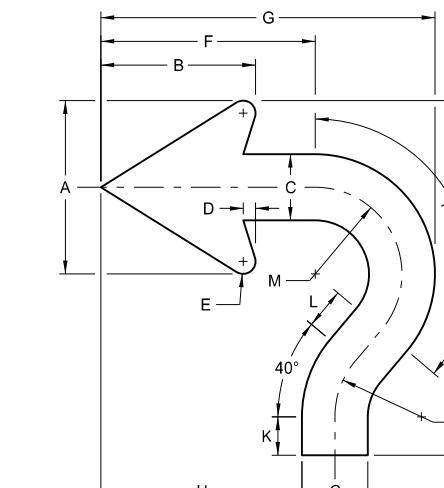


TYPICAL SPACING

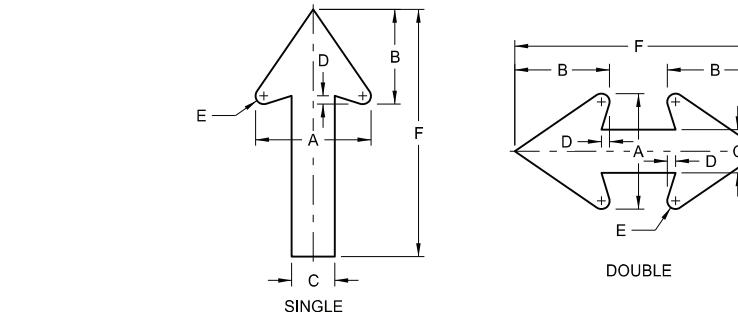


DOWN ARROW

DESIGNATION	LETTER SIZE (Upper Case)	A	B	C	D	E	F	G	H	J	K	L	M
ND_6IN	6"	5.25"	4.688"	2"	0.375"	0.375"	6.5"	10.125"	6.094"	10.75"	1.168"	1.25"	2.625"
ND_8IN	8"	7"	5.75"	2.625"	0.5"	0.5"	8.688"	13.5"	8.166"	14.333"	1.557"	1.667"	3.5"



ROUNDABOUT



SPECIAL

DESIGNATION	A	B	C	D	E	F	USES
ND_0.75IN	2"	1.625"	0.75"	0.125"	0.125"	7.75"	Parking Signs (Regulatory)
ND_2.625IN	7"	5.75"	2.625"	0.5"	0.5"	15"	Frontage Road Signs

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-3-11	
REVISIONS	
DATE	CHANGE
7-8-14	Revised gore sign and added 4" D & D arrow
5-4-16	Revised Distance & Destination and Typical Spacing details
4-23-18	Revised arrow details
8-30-18	Updated notes to active voice.
8-29-19	New Design Engr PE Stamp.
8-05-24	Electronic Stamp/Signature.

KIRK J. HOFF
REGISTERED
PROFESSIONAL
PE-4683
NORTH DAKOTA
ENGINEER

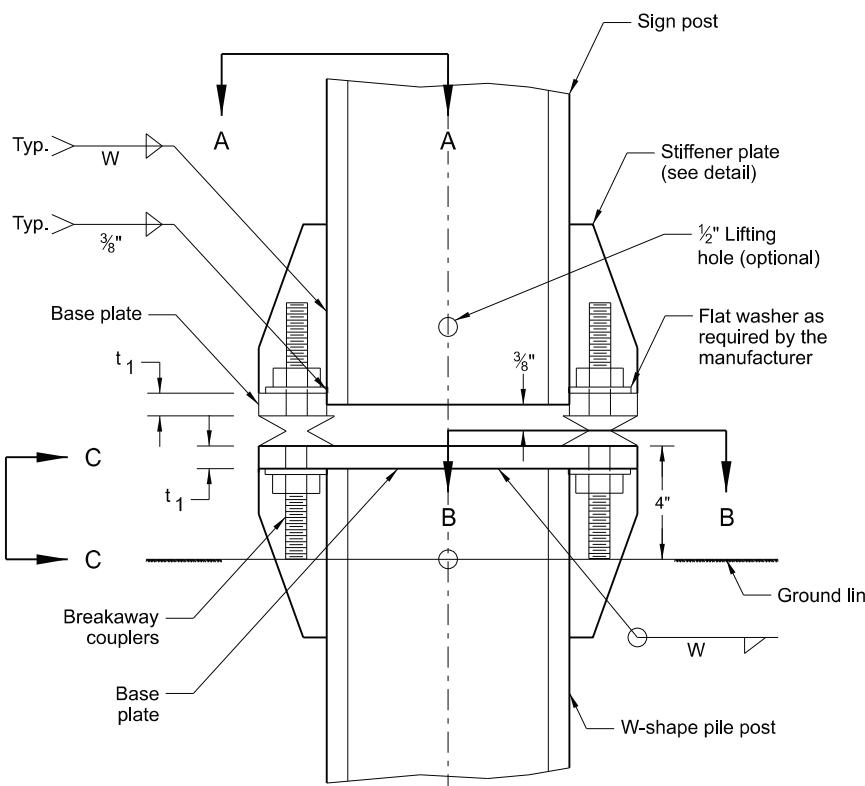
08/05/24

D-754-12

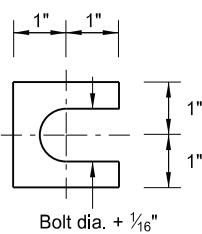
Breakaway Coupler System

Structural Details

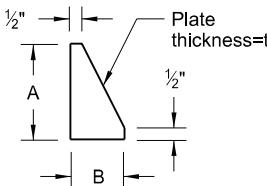
for W-Shape Supports



Sign Post and Stub Post
Elevation

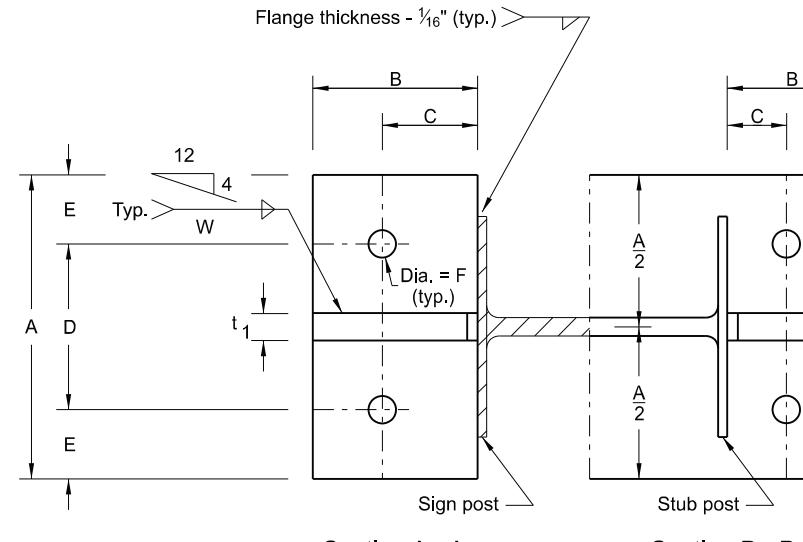


Shim Detail

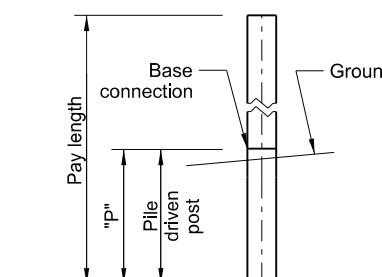


Stiffener Plate Detail
(See Table for Dimensions)

Furnish 2 - .012" \pm thick and 2 - .032" \pm thick shims per post. Fabricate shims from brass shim stock or strip conforming to ASTM B36.



Section A - A
Section B - B
(See Table for Dimensions)

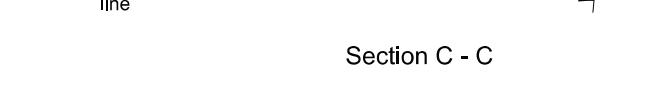


W-Shape - Pile Footing

W-Shape Post & Pile Size	Base Connection Data								W-Shape Post "P"	Footing Data	
	Bolt Size	A	B	C	D	E	t_1	t_2	W	F	
W4X13	3/4" x 5 1/4"	6"	2 1/2"	1 1/2"	3 1/2"	1 1/4"	1"	1/2"	1/4"	13/16"	14'
W5X16											14'
W6X20	7/8" x 5 1/4"	8"	3"	1 3/4"	4"	2"	1 1/4"	1/2"	1/4"	15/16"	14'
W8X24											14'
W8X28	1" x 5 1/4"	8"	3"	2"	4"	2"	1 1/2"	3/4"	5/16"	1 1/16"	14'

Notes:

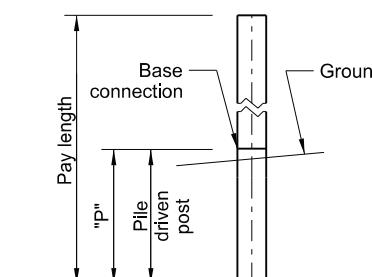
1. Use either the breakaway base system shown on standard D-754-13 or a breakaway coupling system manufactured from material meeting the requirements of ASTM A325 fasteners with the special requirements as specified by DENT BREAKAWAY IND., INC. which meets the requirements of NCHRP Report 350.
2. Use structural steel conforming to Sec. 894.03 B.6 and high strength bolts conforming to ASTM - A325. Refer to "Sign Summary" sheet for specific data on each individual sign installation.
3. Use manufacturer's recommendations for assembly procedures.



Section C - C

Max. protection of the stub post is 4" above a 60" chord aligned radially to the center line of the highway and connecting any point, within the length of the chord, on the ground surface on one side of the support to a point in the ground surface on the other side.

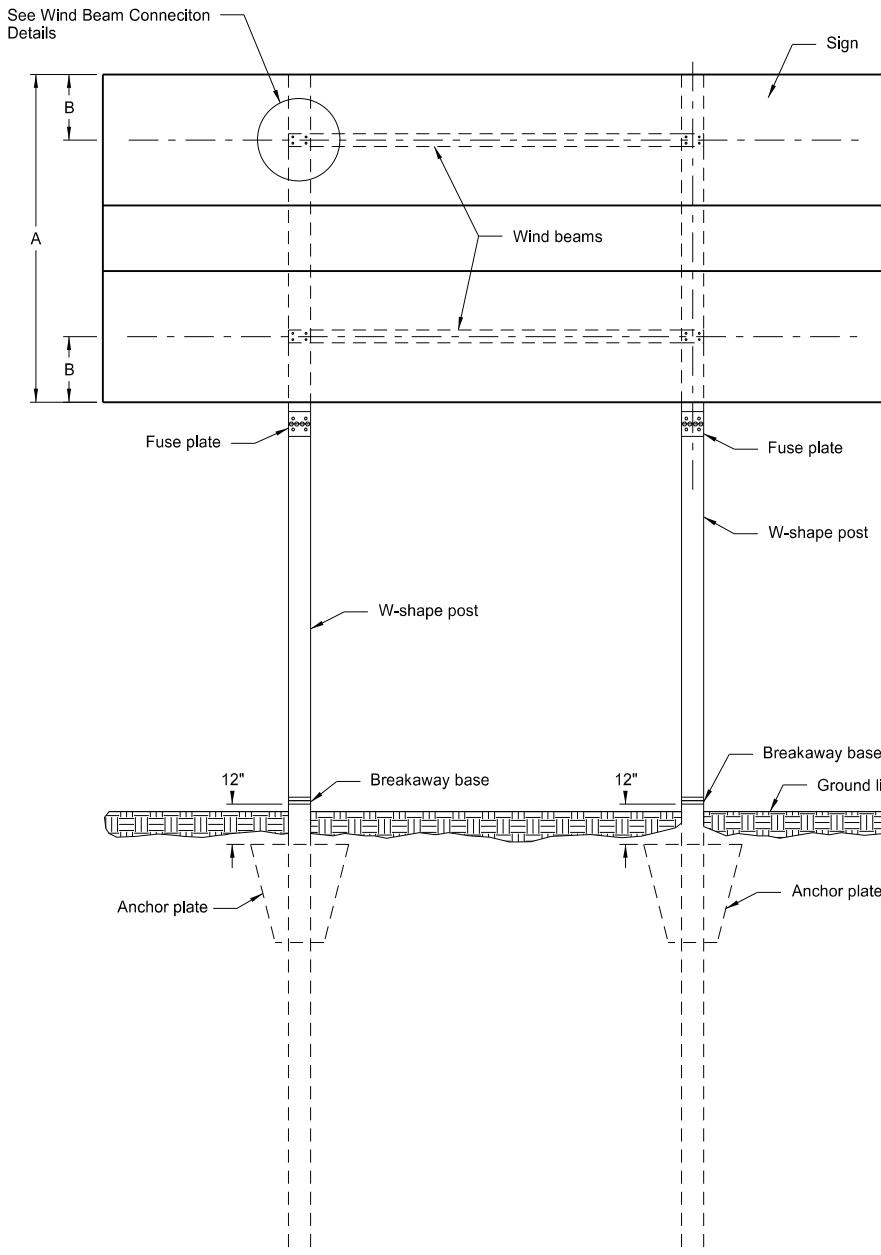
Sections shown are for installations on right shoulder and in gore. Plate slot bevels are opposite hand from that shown for installations on left shoulder.



NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-4-2013	
REVISIONS	
DATE	CHANGE
7-8-14 8-30-18 8-29-19 8-05-24	Revised notes 2 and 3. Updated notes to active voice. New Design Engineer PE Stamp. Electronic Stamp/Signature.
KIRK J. HOFF REGISTERED PROFESSIONAL PE-4683	
Kirk J. Hoff	
NORTH DAKOTA ENGINEER	
08/05/24	

WIND BEAMS AND ANCHOR PLATES
FOR W-SHAPE SUPPORTS

D-754-14

ASSEMBLY DETAIL
FOR WIND BEAMS
AND ANCHOR PLATES

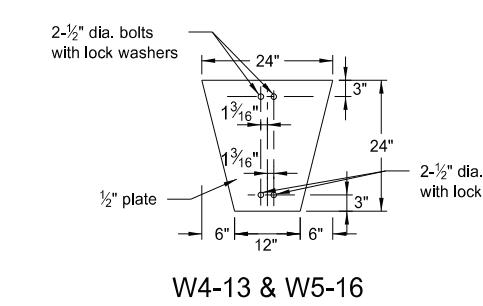
Notes:

Calculate the B distance using the formula, $B=A/4$.

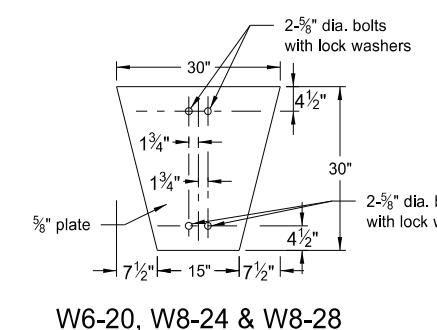
Use wind beam conforming to Section 894.03 B.6 of the Standard Specifications.

Use bolts conforming to ASTM A307 and galvanized according to ASTM A153.

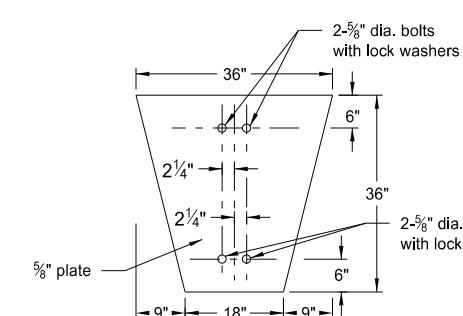
ANCHOR PLATE DETAILS



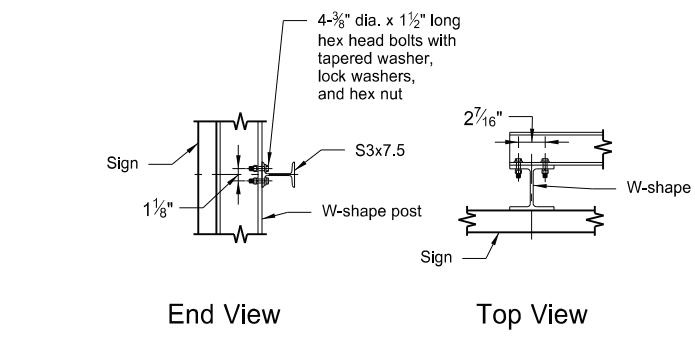
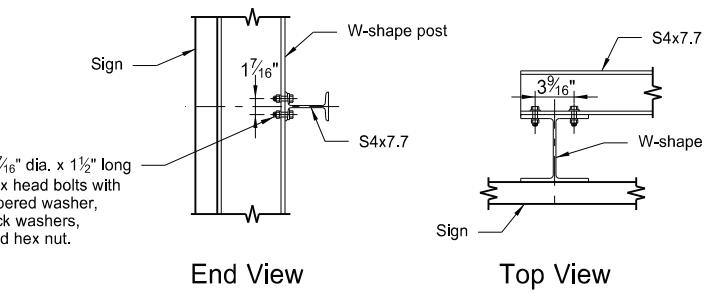
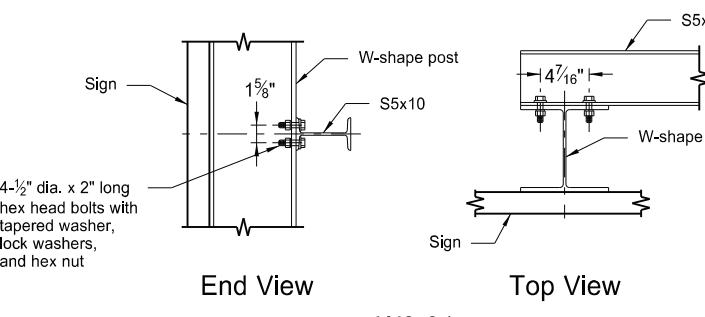
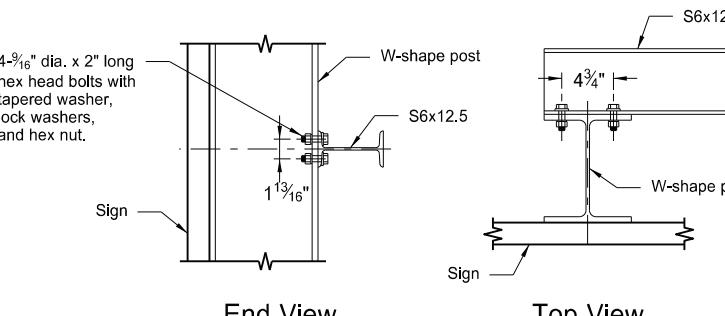
W4-13 & W5-16



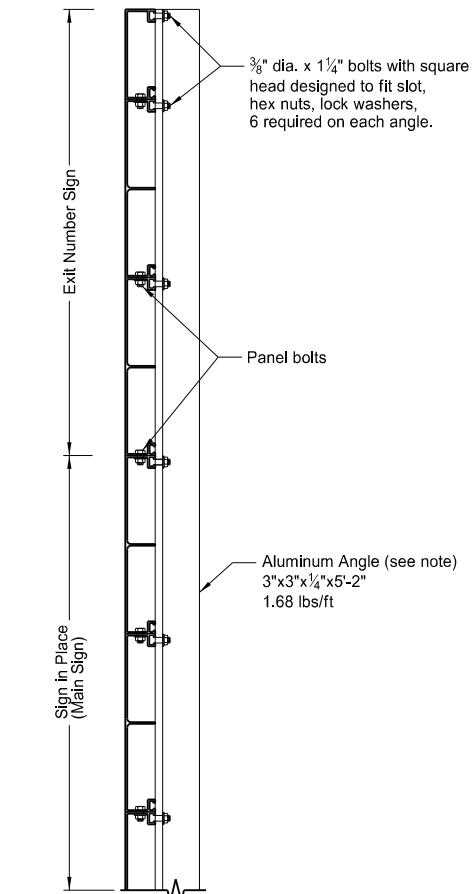
W6-20, W8-24 & W8-28



W8-31 & W10-39

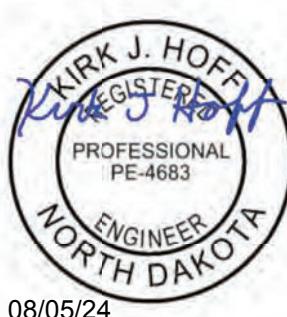
End View
Top View
W4-13 & W5-16End View
Top View
W6-20, W8-24 and W8-28End View
Top View
W8-31End View
Top View
W10-39

WIND BEAM CONNECTION DETAILS

ASSEMBLY DETAIL FOR
EXIT NUMBER SIGNS

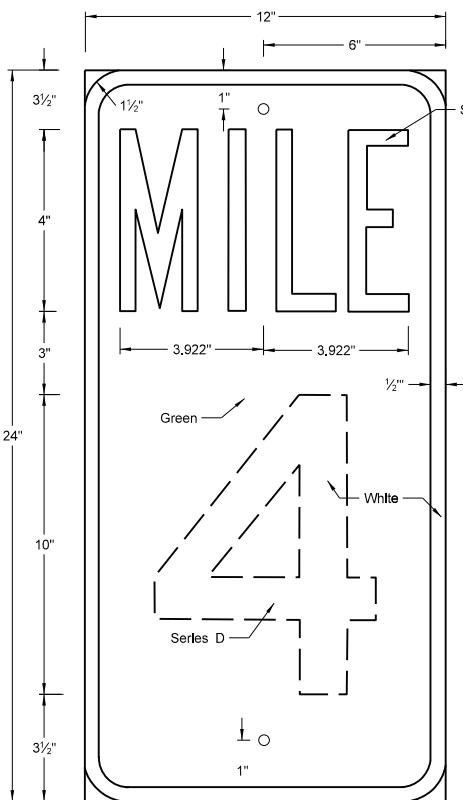
Note: Use two aluminum angles on each sign. Vary distance between angles dependent on post spacing of sign in place. Place angles as near as possible to posts. The Engineer will determine exact location.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-13	
REVISIONS	
DATE	CHANGE
7-8-14 8-30-18 8-29-19 8-05-24	Revised second note. Updated notes to active voice. New Design Engineer PE Stamp. Electronic Stamp/Signature.



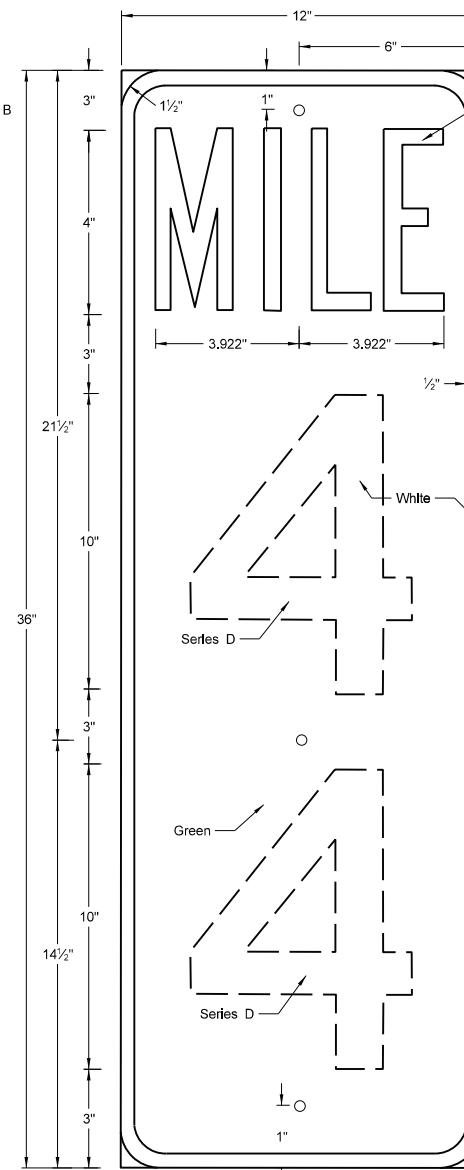
(EXPRESSWAY-FREWAY USE) MILE POSTS

D-754-20



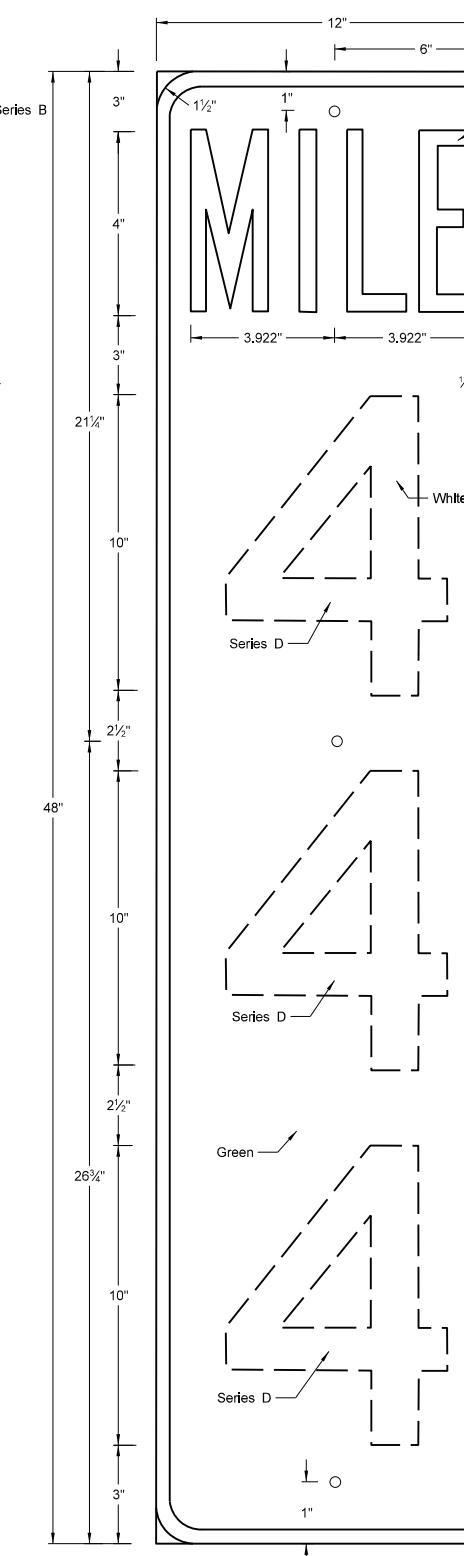
TYPE A

Area = 2.00 S.F.



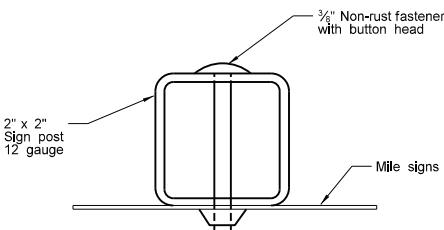
TYPE B

Area = 3.00 S.F.

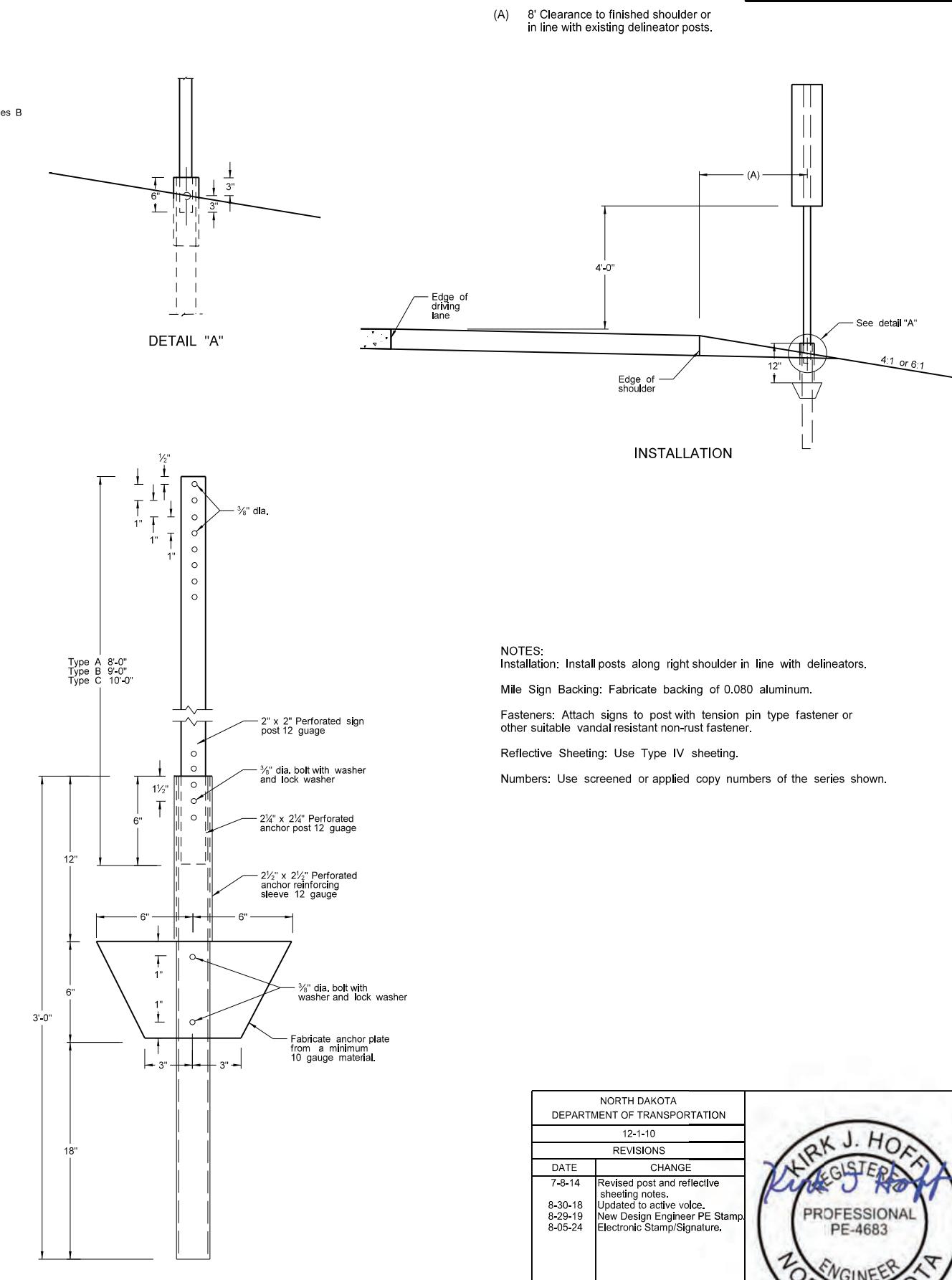


TYPE C

Area = 4.00 S.F.



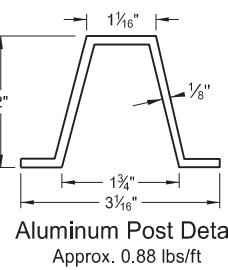
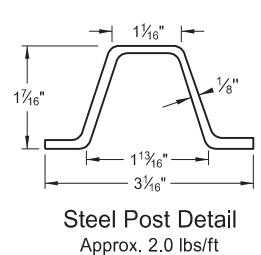
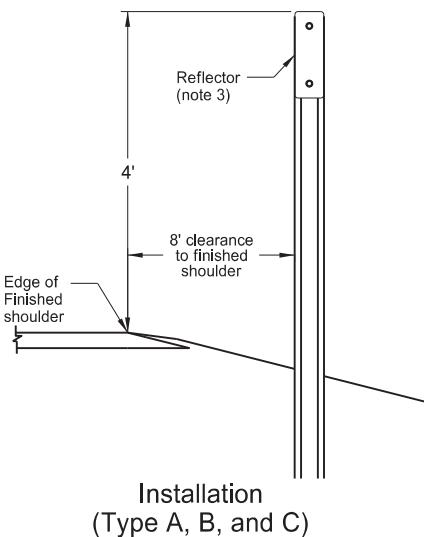
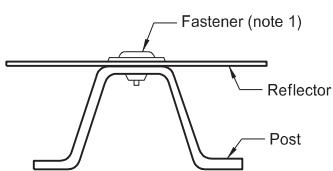
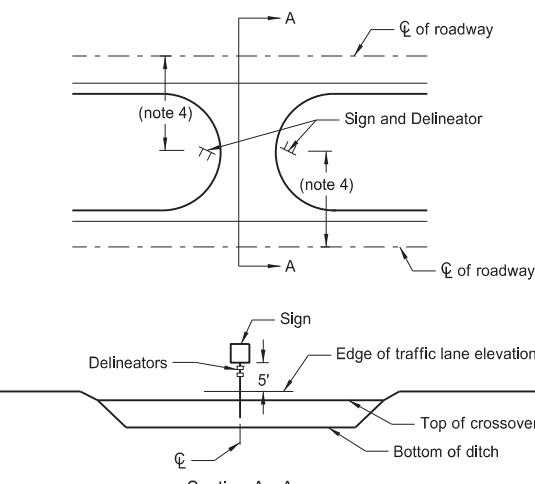
ASSEMBLY DETAIL



NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-1-10	
REVISIONS	
DATE	CHANGE
7-8-14	Revised post and reflective sheeting notes.
8-30-18	Updated to active voice.
8-29-19	New Design Engineer PE Stamp
8-05-24	Electronic Stamp/Signature,



REFLECTORIZED DELINEATORS - DIVIDED HIGHWAY

Installation
(Type A, B, and C)Type A, Type B, and Type C
Delineator Attachment DetailMedian Crossovers
Signing and Delineation system

Delineator Details
Type A, B, and C
Installation: Install posts along the right shoulder line, in the direction of travel, unless shown otherwise on the plans.

Reflectors: Use reflector of the same color as the adjacent pavement marking with a 0.080 inch minimum thickness sign backing material.

Type E

Alternate: As an alternate, use one unit band consisting of two yellow stripes separated by a 2" black stripe in place of two 3" yellow bands.

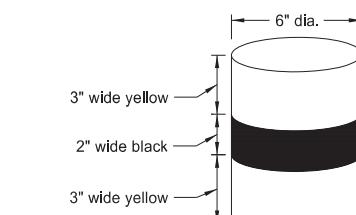
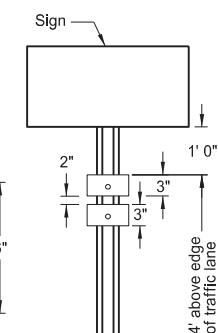
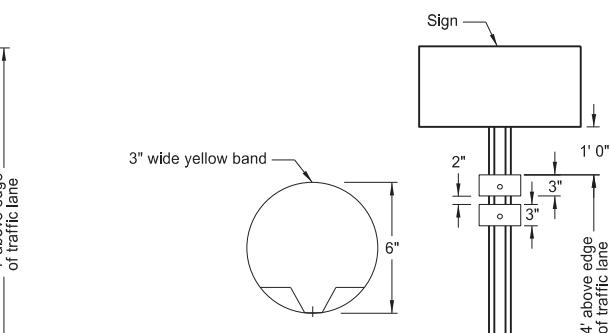
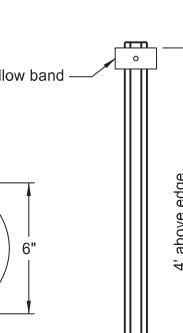
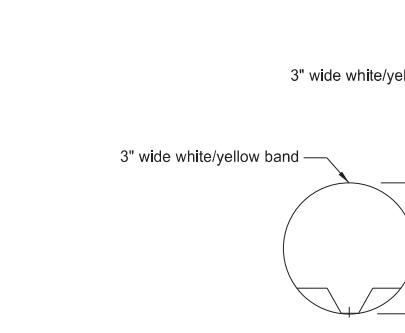
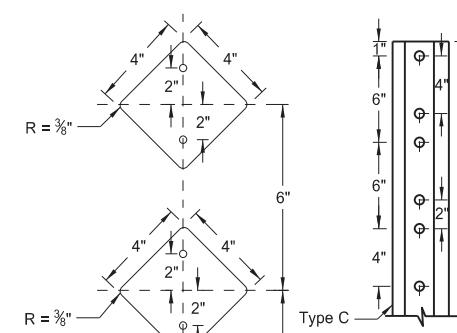
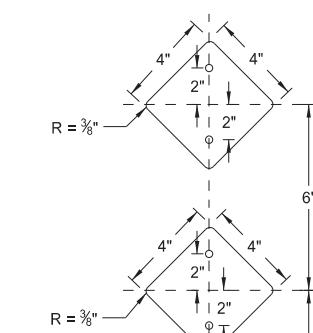
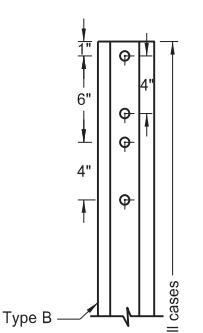
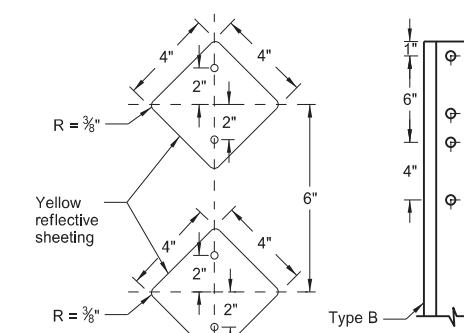
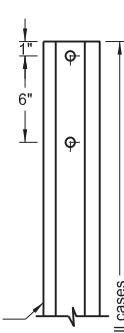
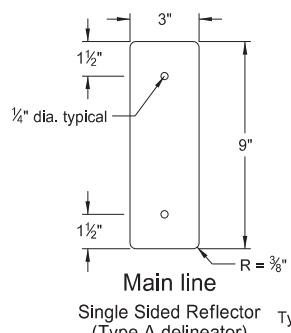
(1) Use fasteners that are a minimum $\frac{1}{4}$ " diameter. Use double headed rivet or other non-rust vandal resistant fastener.

(2) Drill only those holes required to attach the number of reflectors on that post, or drill all the posts the same so that any number of reflectors may be added.

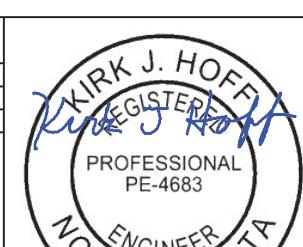
(3) Mount reflector facing traffic at an angle of 90° away from oncoming traffic.

(4) Median width may vary. Place sign and delineator assembly in the median crossover an equal distance from each roadway.

(5) Include all costs for materials, labor, and equipment to install single sided type A delineators in the unit price bid for "Delineators-Type A-Single Sided." Include all costs for materials, labor, and equipment to install single sided type B, type C, type D, and type E delineators in the unit price bid for "Delineators-Type B", "Delineators-Type C", "Delineators-Type D", and "Delineators-Type E."

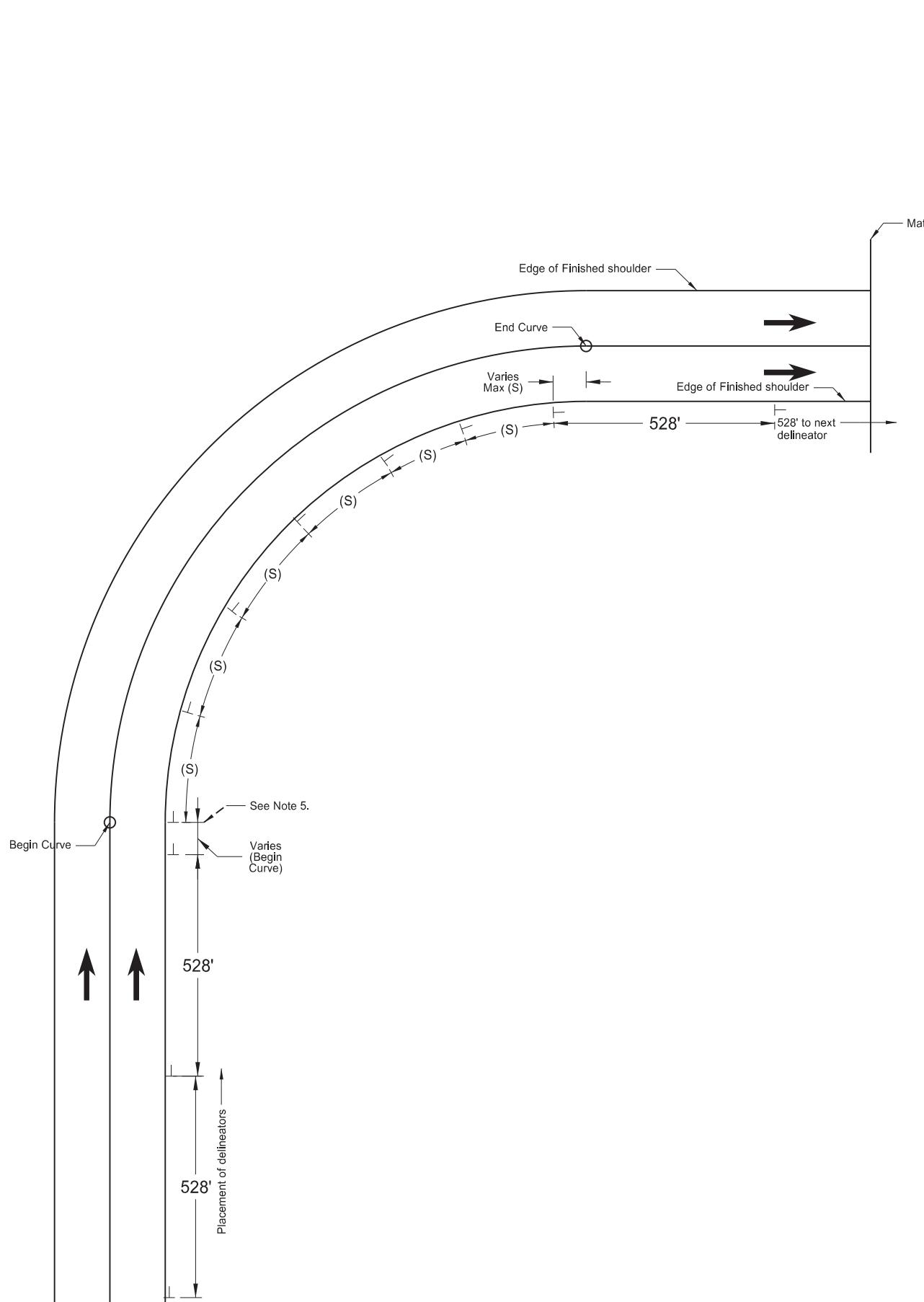


NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12/16/22	
REVISIONS	
DATE	CHANGE



TYPE A REFLECTORIZED DELINEATOR SPACING - DIVIDED HIGHWAY

D-754-21A



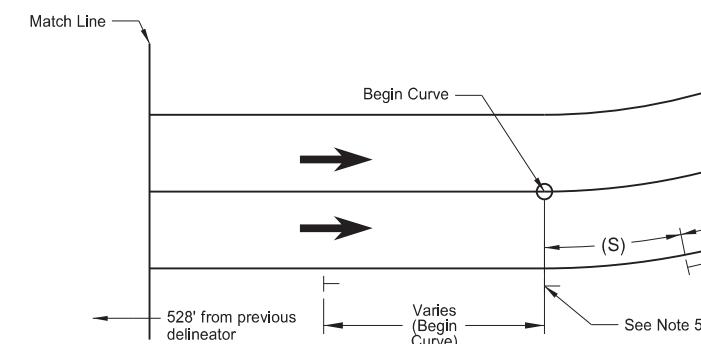
Spacing

Curve Radius	Spacing (S) on Cent
$R > 11,500'$	528'
$11,500' \geq R > 1,200'$	264'
$1,200' \geq R$	See table below

Radius (R) of Curve	Approx. Spacing (S) on Curve
1,200' \geq R > 1,000'	90'
1,000' \geq R > 800'	80'
800' \geq R > 500'	65'
500' \geq R > 300'	50'
300' \geq R > 180'	35'
180' \geq R > 50'	20'

Note:

1. Do not place delineators within 100' of a railroad crossing. Shift delineators in either direction to minimize impact to uniform spacing. Reestablish uniform spacing based on the last delineator location.
2. For Type A delineators that land within approaches or ramps, shift delineators in either direction a distance not exceeding $\frac{1}{4}$ of the uniform spacing. Eliminate delineators that still fall within approaches or ramps.
3. Eliminate delineators landing within guardrail. Reestablish uniform spacing based on last delineator.
4. Do not place delineators within $\frac{1}{4}$ of the uniform spacing of a reference point marker.
5. Install Type A delineators along the right shoulder line at the start of each curve.
6. Only one roadway is shown. When installation is required for both roadways, install Type A delineators on each roadway as shown (independent of the other roadway).
7. Discontinue delineators on outside of curve where chevrons exist.

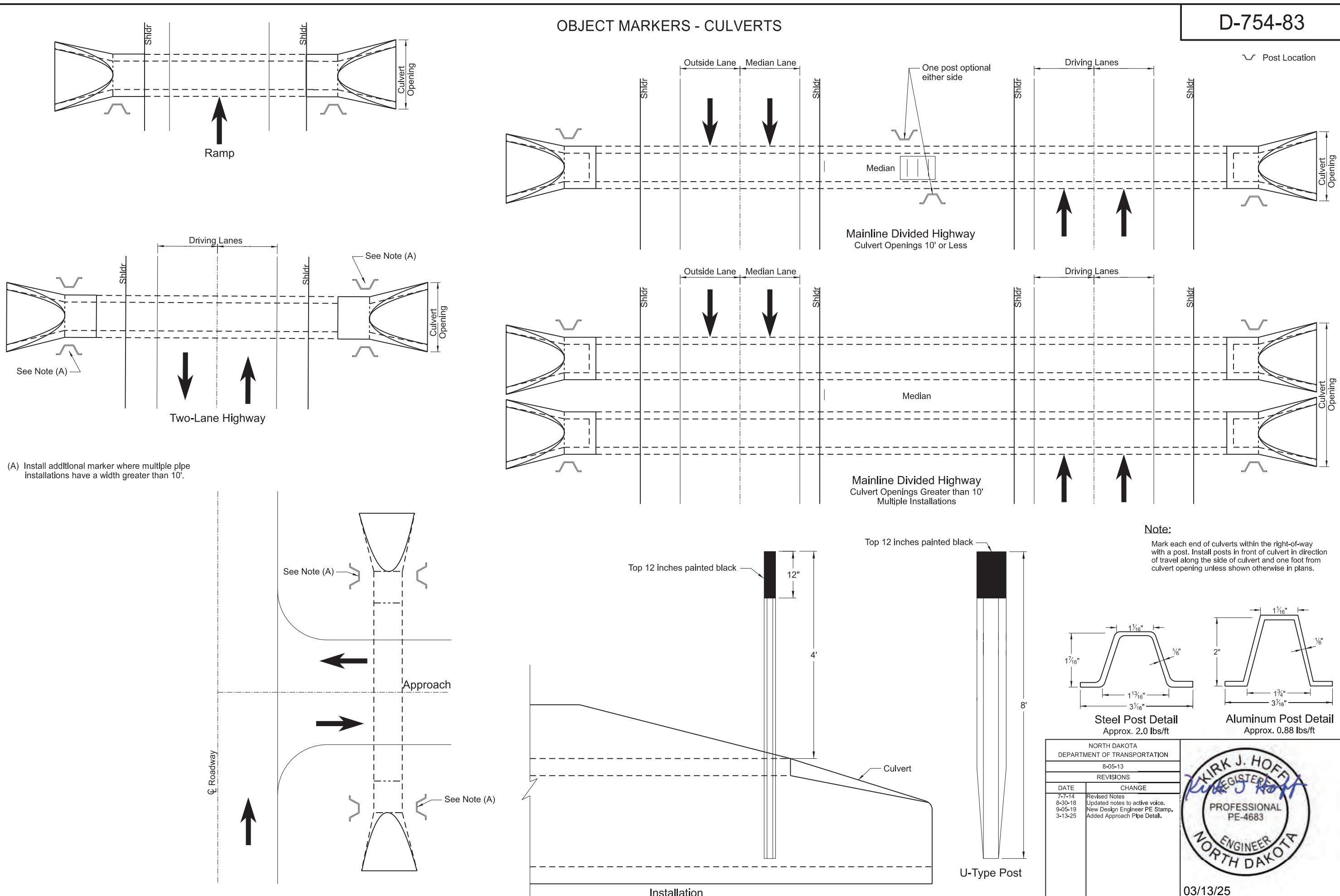


NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

12/16/22

OBJECT MARKERS - CULVERTS

D-754-83

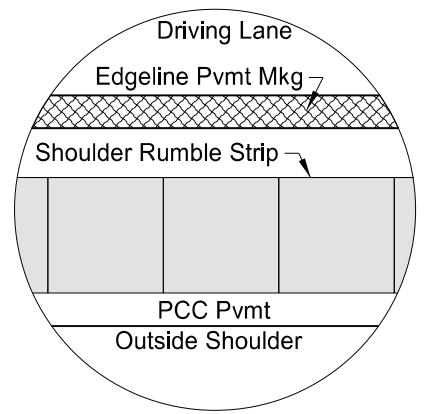
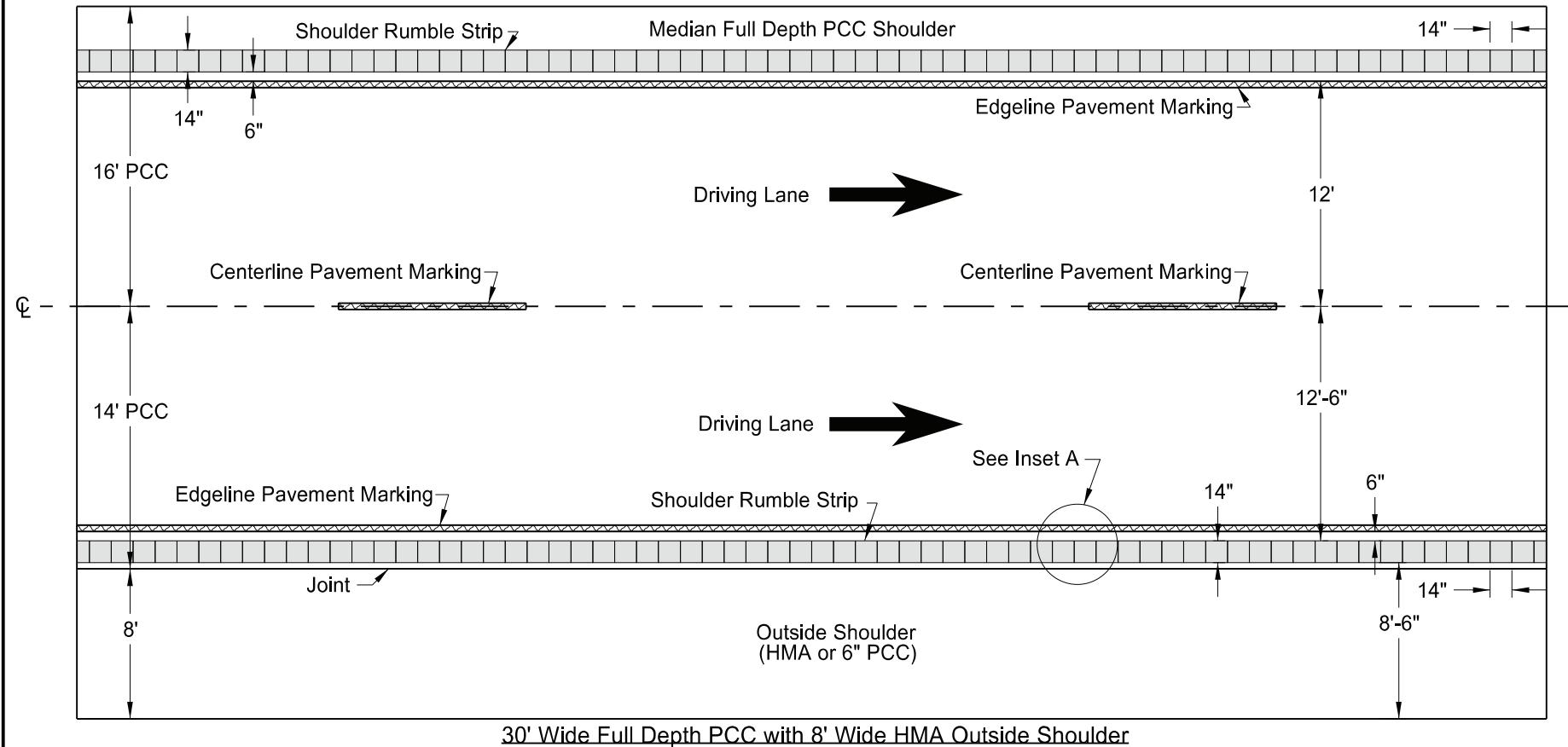


RUMBLE STRIPS
INTERSTATE HIGHWAYS

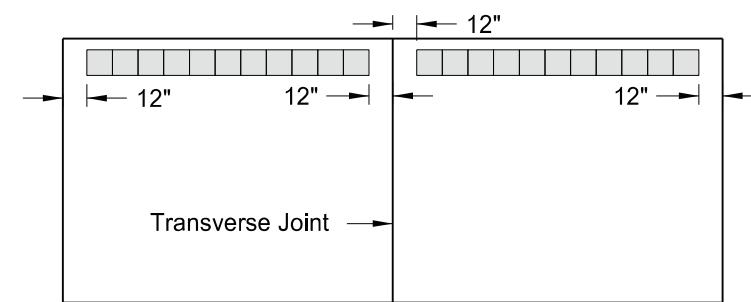
D-760-1

NOTES:

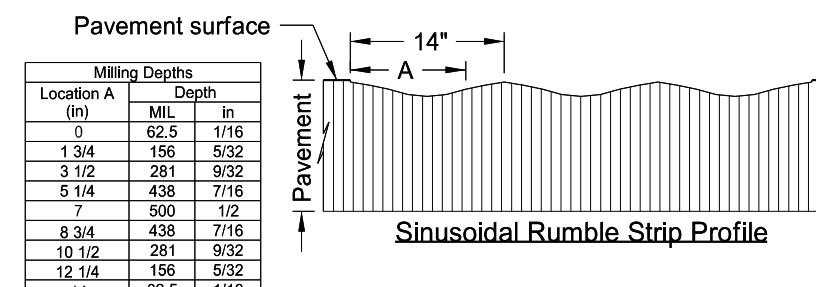
1) Discontinue rumble strips through ramps and tapers.



Inset A - Shoulder Rumble Strip
(Layout for opposite shoulder reversed)



Discontinue rumble strip approx. 12" on both sides of PCC transverse joint

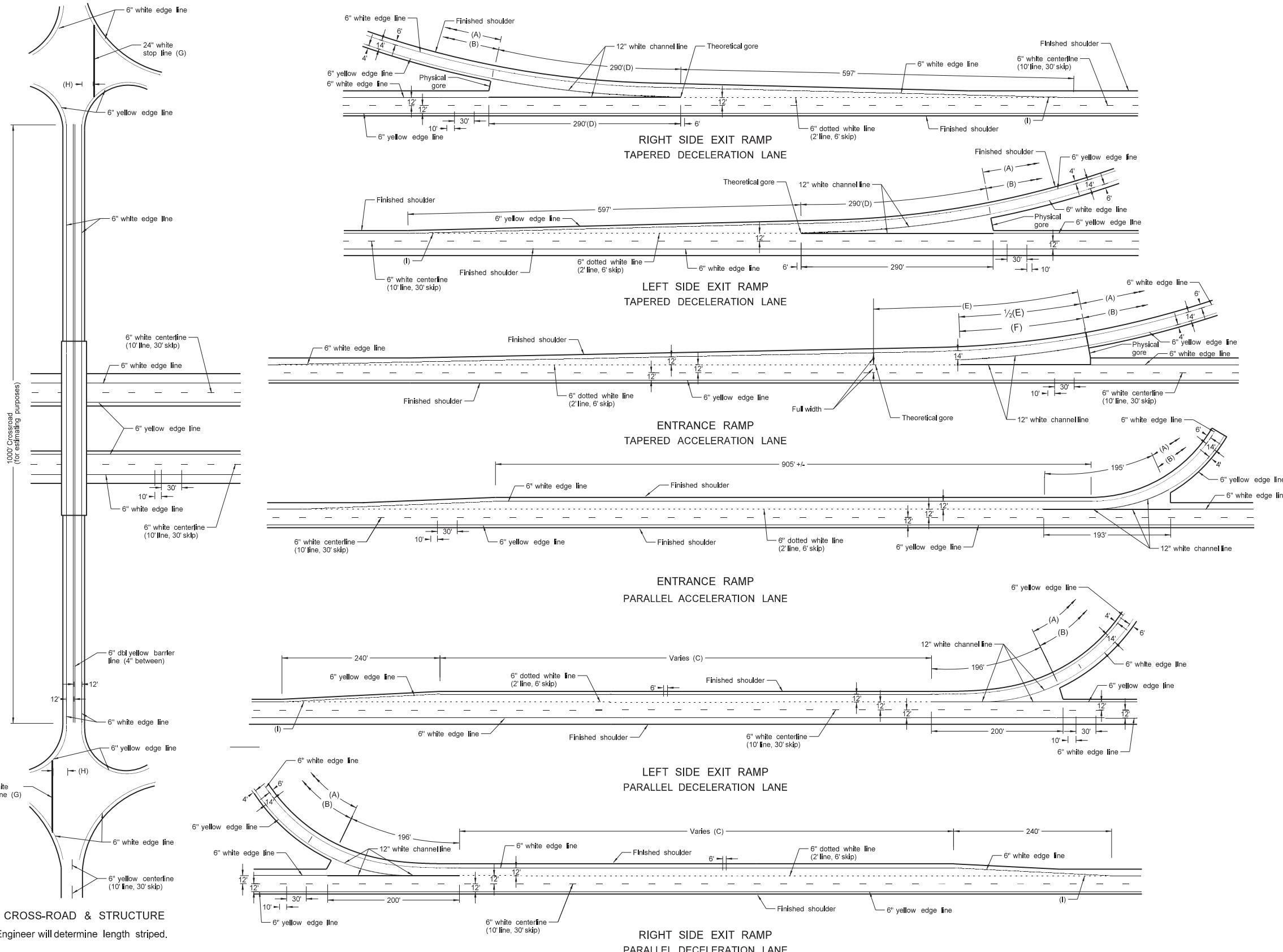


NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-29-09	
DATE	CHANGE
2-25-10 9-08-11 8-30-18 10-25-19 11-16-21 5-26-23	Note 4 was added. Revised Notes and D-760-1. Revised drawings for clarity. Added mils/m dimensions. Added rumble strips to end of taper. Rumble strips made sinusoidal.



INTERSTATE PAVEMENT MARKING
4 LANE DIVIDED HIGHWAY

D-762-2



NOTE:

- (A) Normal width white edge line - 6 inches wide for freeways, expressways, and ramps; 6 inches for all other roadways with speed limits > 40 mph. Use 4 or 6 inch wide pavement marking for all other roadways with speed limits ≤ 40 mph.
- (B) Normal width yellow edge line - 6 inches wide for freeways, expressways, and ramps; 6 inches for all other roadways with speed limits > 40 mph. Use 4 or 6 inch wide pavement marking for all other roadways with speed limits ≤ 40 mph.
- (C) Assume "varies" equals 790' for purpose of estimate. Place pavement marking from beginning of taper to the 12" line.
- (D) Beginning of physical gore to theoretical gore. If the distance is less than 350' extend the 12" channel line to the theoretical gore, otherwise use 195'.
- (E) Use 195' for estimating purposes.
- (F) Not required for gravel surface crossroad approaches.
- (G) 4' minimum, 15' maximum from nearest edge of intersection traveled way.
- (I) Extend dotted line until it touches the edgeline.

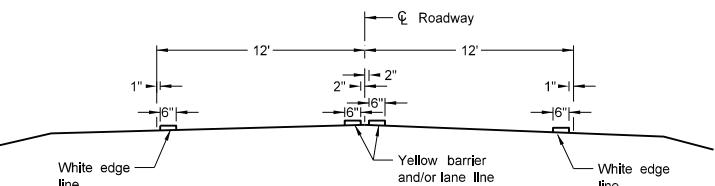
LOCATION	BASIS OF ESTIMATE	
	ITEM	LF
Right or Left Side Exit Ramp TAPERED	12" White channel line	580 LF
	24" White stop line	60 LF
	6" White dotted line	148 LF
	6" White edge line	1115 LF
	6" Yellow edge line	1075 LF
Entrance Ramp TAPERED	12" White channel line	390 LF
	6" White dotted line	258 LF
	6" White edge line	1270 LF
	6" Yellow edge line	1075 LF
Right or Left Side Exit Ramp PARALLEL	12" White channel line	396 LF
	24" White stop line	60 LF
	6" White dotted line (C)	258 LF
	6" White edge line	1115 LF
	6" Yellow edge line	1075 LF
Entrance Ramp PARALLEL	12" White channel line	388 LF
	6" White dotted line	283 LF
	6" White edge line	1275 LF
	6" Yellow edge line	1075 LF
Main Lane (Both Roadways)	6" White lane line, 10' line, 30' skip	2640 LF/MI
	6" White edge line	10,560 LF/MI
	6" Yellow edge line	10,560 LF/MI
Cross Road	6" White edge line	2000 LF
	6" Dbl yellow barrier line (4" between)	2000 LF

DATE	CHANGE	NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
		8-3-11	REVISIONS
10-17-17 10-25-19 11-05-21 11-22-23 1-17-24	Updated to active voice Replaced 2' Max dim with Note (I) Revised labels Revised pmt marking widths Revised wide pmt marking width		

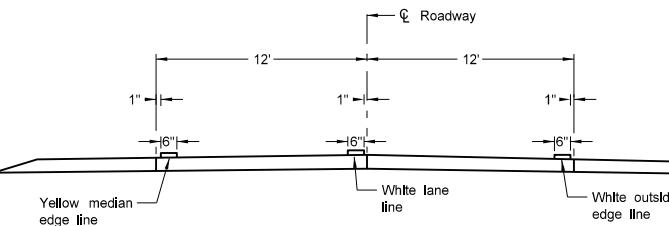


PAVEMENT MARKING

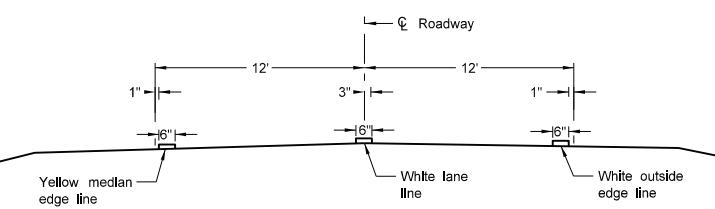
D-762-4



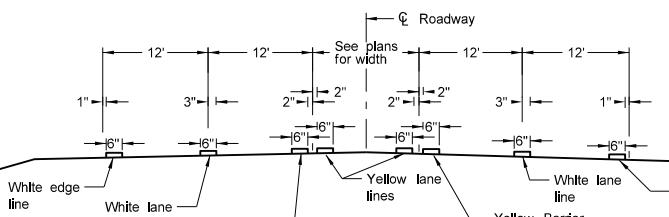
Two Lane Two Way
RURAL ROADWAY



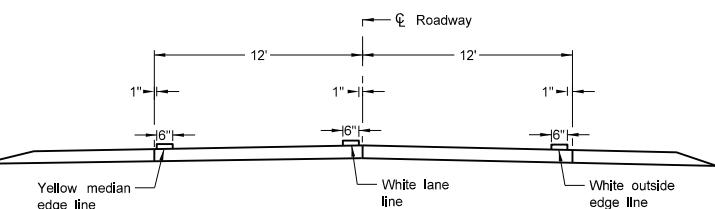
Two Lane Roadway
INTERSTATE HIGHWAY
Concrete Section



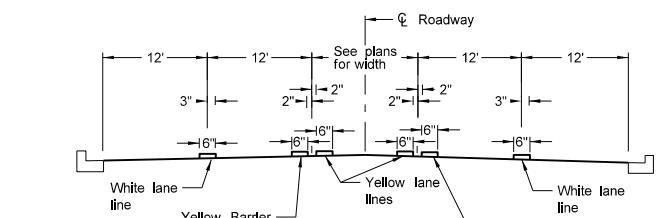
Two Lane Divided
Rural Roadway
PRIMARY HIGHWAY
Asphalt Section



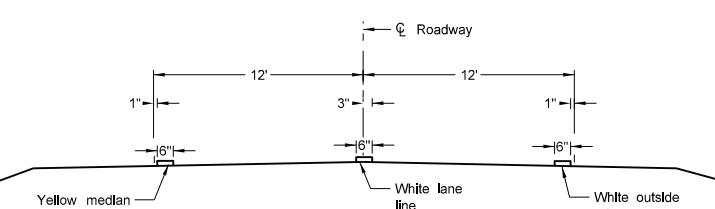
RURAL FIVE LANE ROADWAY
Asphalt Section



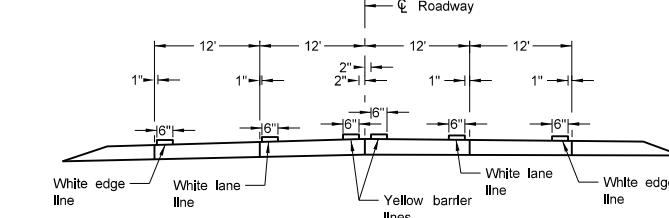
Two Lane Divided
Rural Roadway
PRIMARY HIGHWAY
Concrete Section



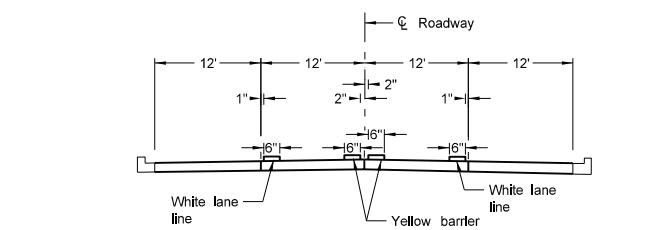
URBAN FIVE LANE SECTION
Asphalt Section



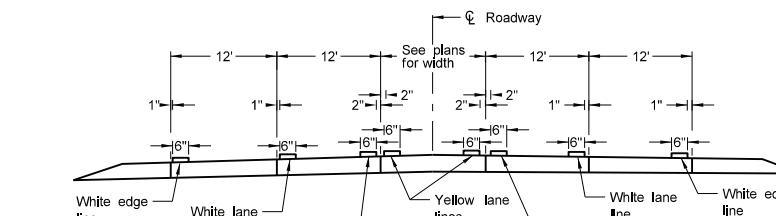
Two Lane Roadway
INTERSTATE HIGHWAY
Asphalt Section



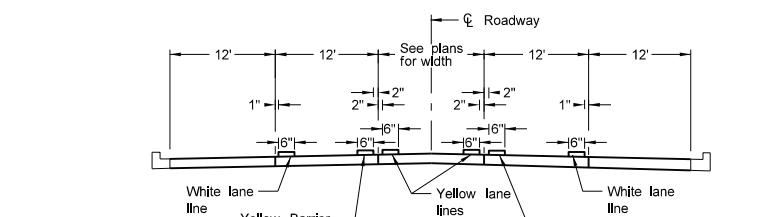
RURAL FOUR LANE ROADWAY
Concrete Section



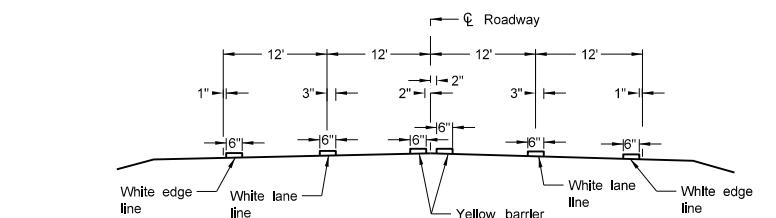
URBAN FOUR LANE SECTION
Concrete Section



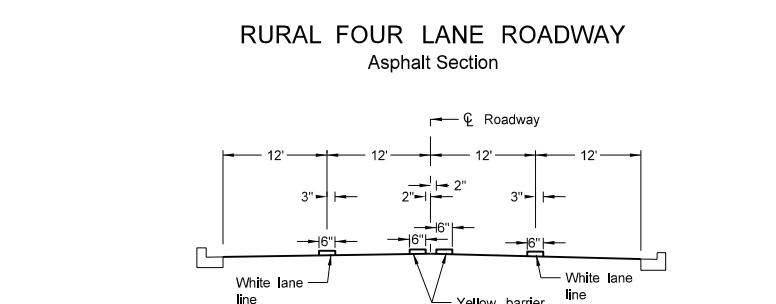
RURAL FIVE LANE ROADWAY
Concrete Section



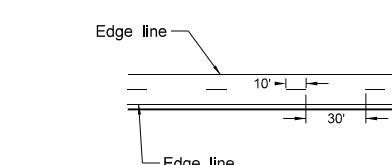
URBAN FIVE LANE SECTION
Concrete Section



RURAL FOUR LANE ROADWAY
Asphalt Section



URBAN FOUR LANE SECTION
Asphalt Section



CENTERLINE PAVEMENT MARKING SKIP SPACING DETAIL

NOTES:

1. Continue edge lines through private drives and field drives. Break edge lines for intersections.

For section lines, county roads, and street approaches, stripe the radii and edge lines of the paved surface within the right of way except where curb and gutter is present.

2. Normal width line - 6 inches wide for freeways, expressways, and ramps; 6 inches for all other roadways with speed limits > 40 mph.

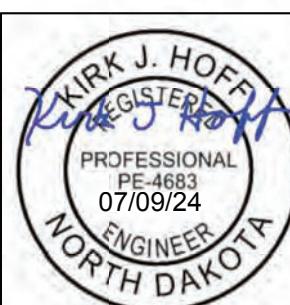
3. Use 4 or 6 inch wide pavement marking for all other roadways with speed limits < 40 mph.

NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

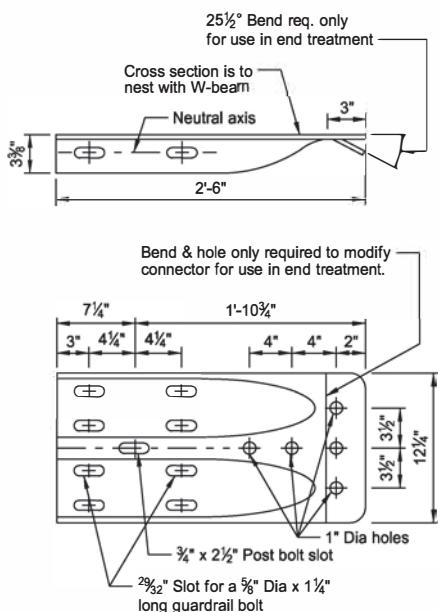
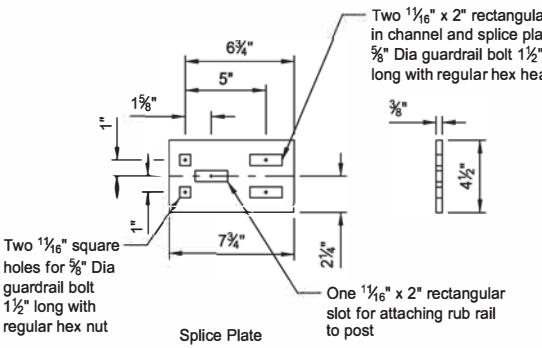
12-1-10

REVISIONS

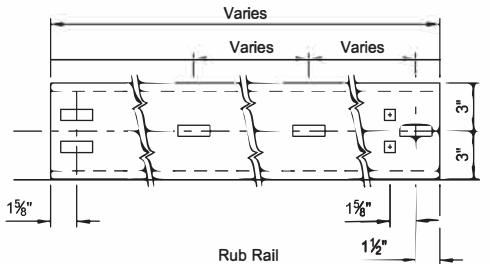
DATE	CHANGE
10-17-17 08-27-19 11-22-23 07-09-24	Updated to active voice. New Design Engineer PE Stamp. Revised pavement marking widths. Modified Note 1.



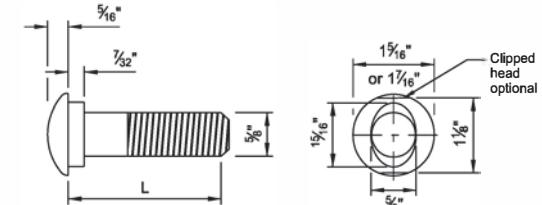
W-BEAM GUARDRAIL GENERAL DETAILS



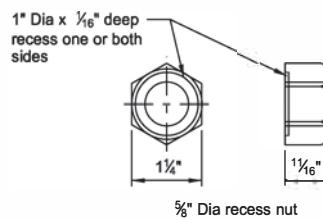
W BEAM TERMINAL CONNECTOR



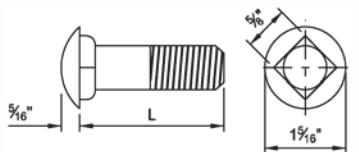
C6x8 RUB RAIL AND SPLICE PLATE



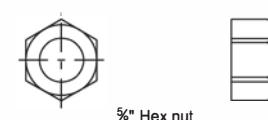
5/8" Diameter Guardrail Bolt	
L	Thread Length
1 1/4"	Full length thread
2"	1 3/4" Min thread length
9 1/2"	4" Min thread length
18"	4" Min thread length
20"	4" Min thread length
22"	4" Min thread length
25"	4" Min thread length



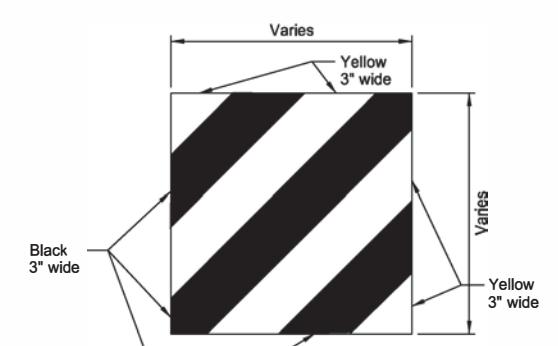
5/8" GUARDRAIL BOLT & RECESS NUT



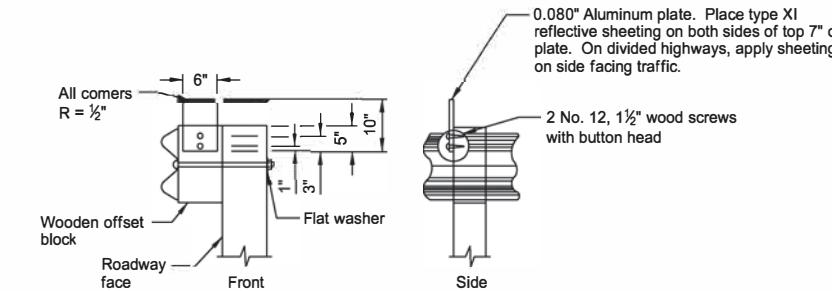
5/8" Diameter Carriage Bolt	
L	Thread Length
1 1/2"	Full length thread
3"	1 1/2" Min thread length
11"	1 3/4" Min thread length
13"	1 3/4" Min thread length



5/8" CARRIAGE BOLT & NUT

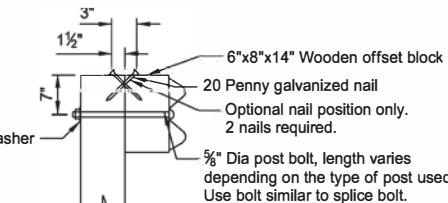


IMPACT HEAD OBJECT MARKER

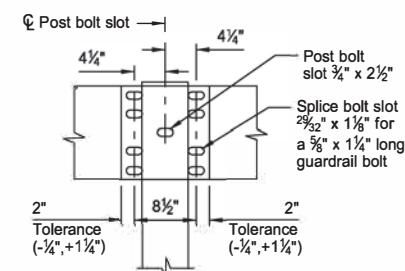


REFLECTORIZED PLATE DETAIL

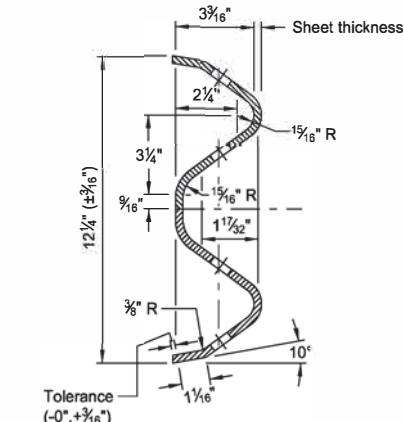
Additional reflectors are added to the W-beam guardrail quantities for placement on end treatment.



TYPICAL POST ATTACHMENT DETAIL



SPICE DETAIL



W-BEAM CROSS SECTION

NOTES:

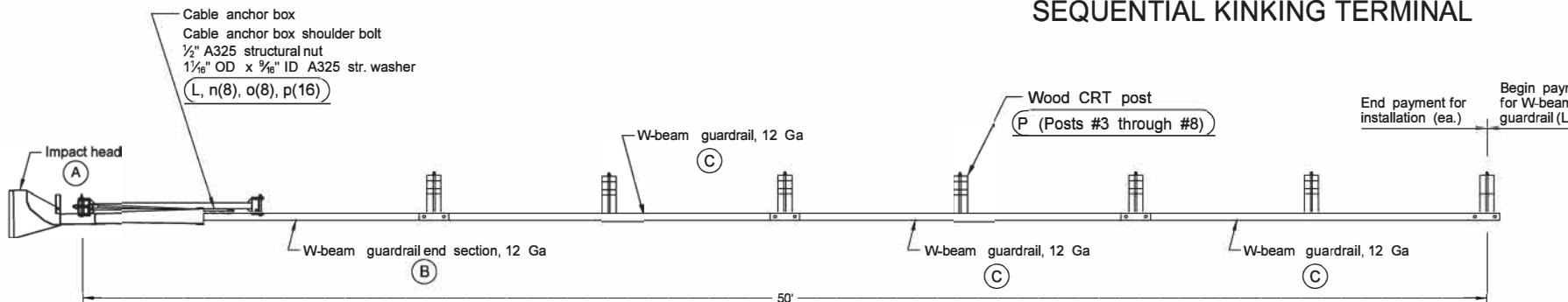
1. Place reflector plates at the first post and spaced at 25' centers on guardrail less than 250' in length and at 50' centers for guardrail over 250' in length. Use reflector the same color as the pavement marking adjacent to that reflector unless noted otherwise on the plans.
2. Dispose of excess earth from excavations for guard posts as directed by the engineer. Replace bituminous material where guardrail is installed after mat is placed. Include cost of excavation and replacing of bituminous material in the price bid for other items.
3. Place Object Marker within the vertical edges of the Impact Plate. Use type XI retroreflective sheeting meeting the requirements of Section 894.02.E of the standard specifications. Apply sheeting to 0.100 Aluminum sheeting meeting the requirements Section 894.01.A. Attach the Object Marker to the Impact Head Plate with non-rust rivets or some other non-rust attachment device. Slope stripes downward toward the roadway side.
4. Guardrail installation height tolerance = - $\frac{1}{4}$ ", + 1".
5. Standard W-Beam rail post bolt slot spacing is 6'-3". Post bolt slot spacing of 3'-1 $\frac{1}{2}$ " is acceptable.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-11-13	
REVISIONS	
DATE	CHANGE
10-25-19	Updated notes to active voice and added Note 5.
12-02-20	Updated clipped head to optional

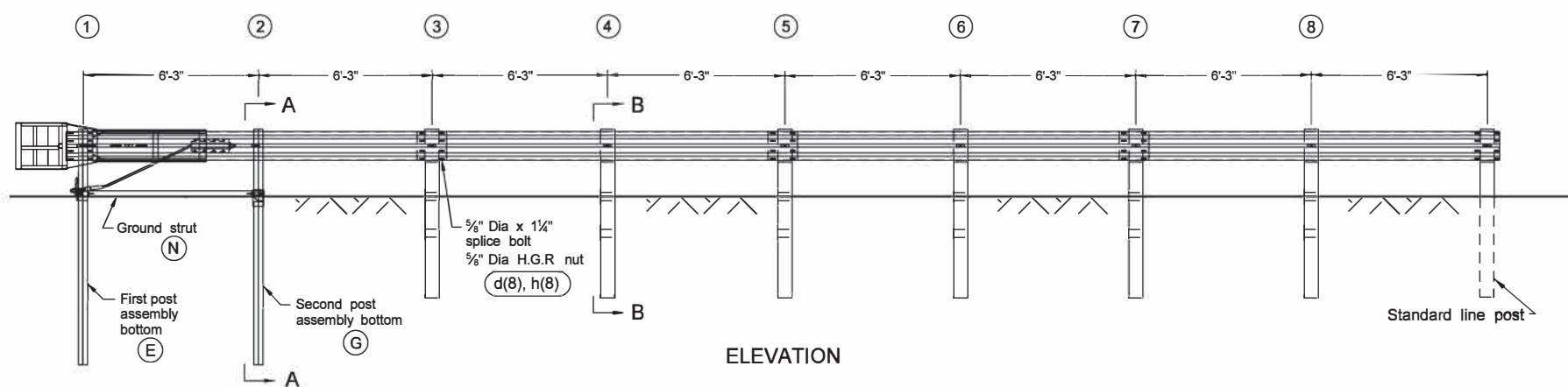


SEQUENTIAL KINKING TERMINAL

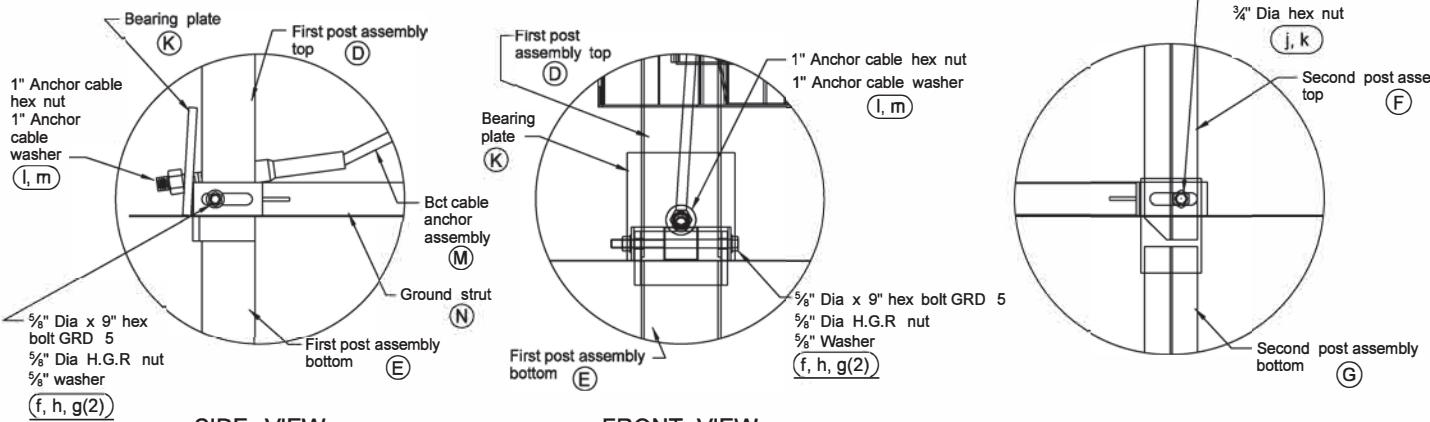
D-764-5



PLAN



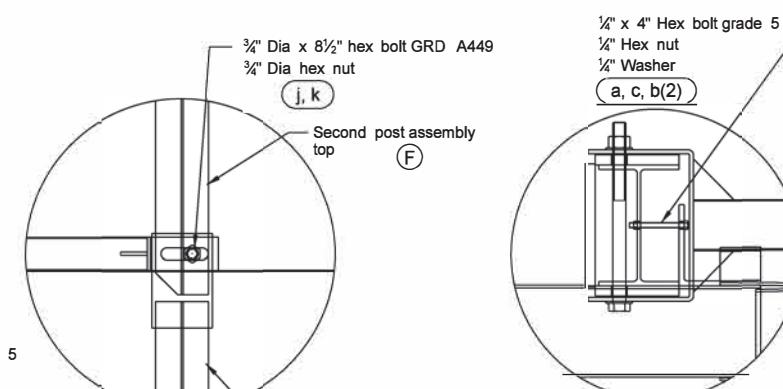
ELEVATION



SIDE VIEW

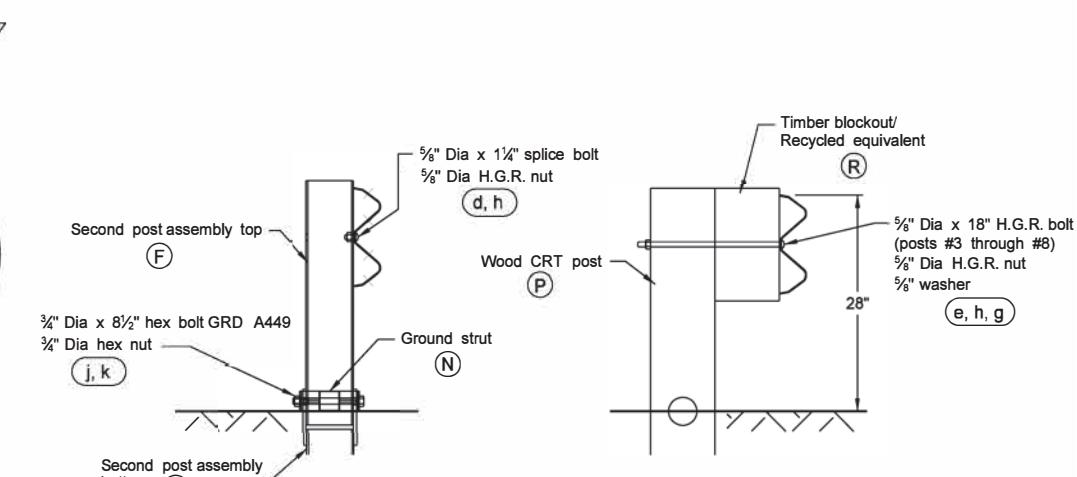
FRONT VIEW

POST #1 CONNECTION DETAILS



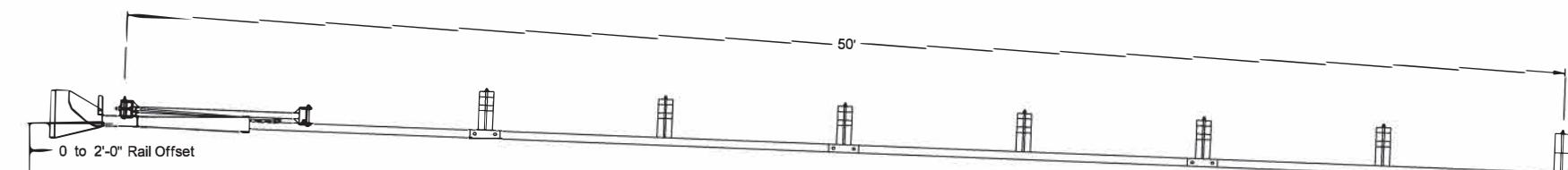
SIDE VIEW DETAIL OF POST #2

IMPACT HEAD CONNECTION DETAIL



SECTION A A

SECTION B-B
Posts #3 through #8



FLARED INSTALLATION
25:1 maximum flare rate

ITEM	QTY	BILL OF MATERIALS
A	1	IMPACT HEAD
B	1	W-BEAM GUARDRAIL END SECTION, 12 Ga
C	3	W-BEAM GUARDRAIL, 12 Ga
D	1	FIRST POST ASSEMBLY TOP
E	1	FIRST POST ASSEMBLY BOTTOM
F	1	SECOND POST ASSEMBLY TOP
G	1	SECOND POST ASSEMBLY BOTTOM
K	1	BEARING PLATE
L	1	CABLE ANCHOR BOX
M	1	BCT CABLE ANCHOR ASSEMBLY
N	1	GROUND STRUT HINGED POST
P	6	WOOD CRT POST
R	6	TIMBER BLOCKOUT/RCY EQUIVALENT
		HARDWARE
a	2	1/4" x 4" HEX BOLT Grade 5
b	4	1/4" WASHER
c	2	1/4" HEX NUT
d	25	5/8" Dia X 1 1/4" SPLICE BOLT, POST #2
e	6	5/8" Dia X 18" H.G.R. BOLT (POSTS 3 THRU 8)
f	1	5/8" Dia X 9" HEX BOLT GRD 5
g	8	5/8" WASHER
h	32	5/8" Dia H.G.R. NUT
j	1	3/4" Dia X 8 1/2" HEX BOLT GRD A449
k	1	3/4" Dia HEX NUT
l	2	1" ANCHOR CABLE HEX NUT
m	2	1" ANCHOR CABLE WASHER
n	8	GROUND STRUT HINGED POST
o	8	1/2" A325 STRUCTURAL NUT
p	16	1 1/8" OD X 5/16" ID A325 STR. WASHER

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-11-13	
REVISIONS	
DATE	CHANGE
12-02-20	Updated notes to active voice.

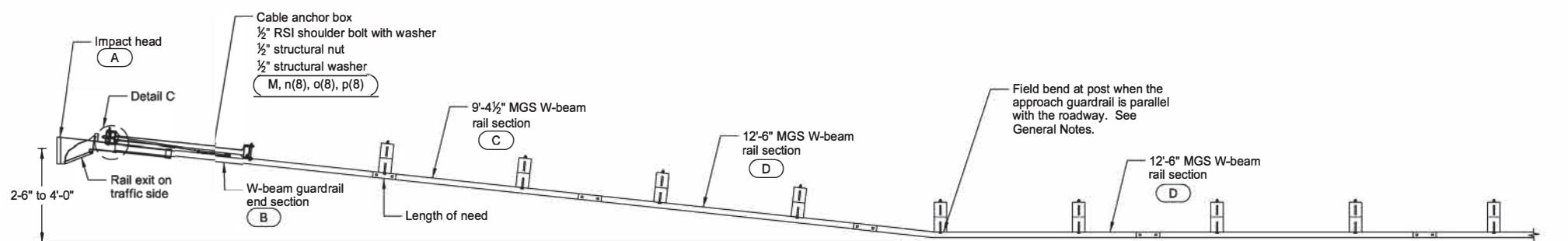


Kirk J. Hoff
PROFESSIONAL
PE-4683
NORTH DAKOTA
ENGINEER

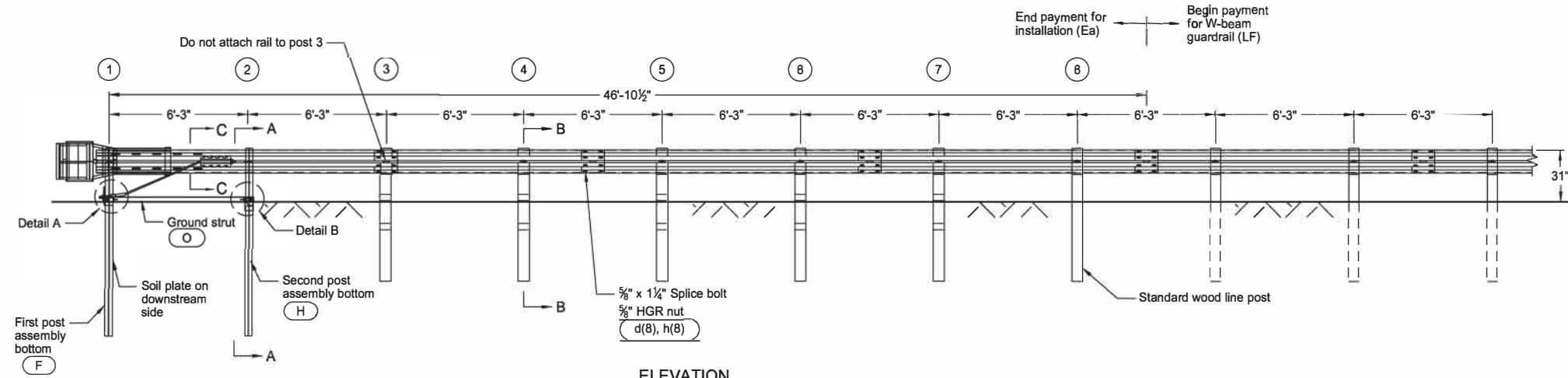
12 02 2020

MGS FLARED ENERGY ABSORBING TERMINAL - WOOD POST

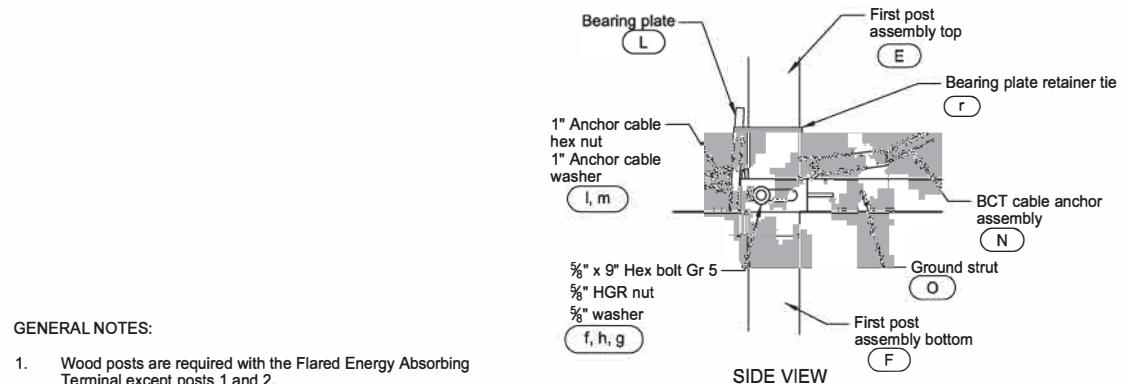
D-764-38



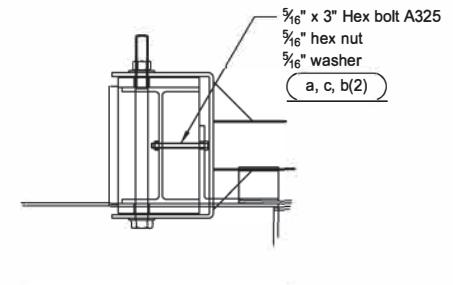
PLAN



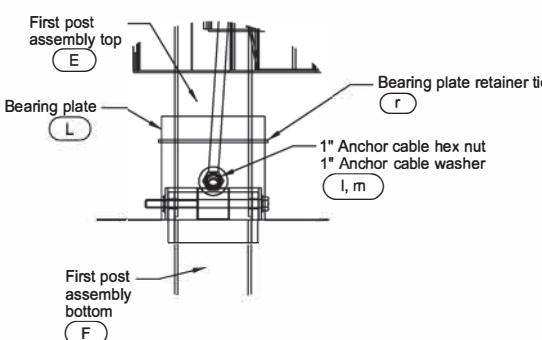
ELEVATION



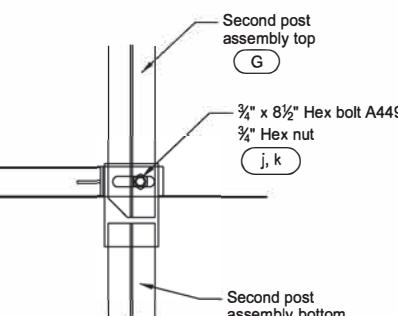
SIDE VIEW



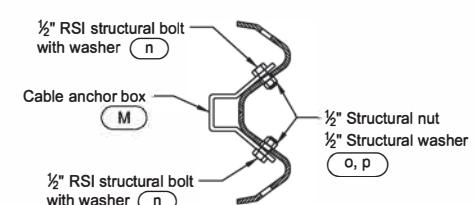
DETAIL C
Post 1 (Impact Head connection)



FRONT VIEW
DETAIL A
Post 1



DETAIL B
Post 2



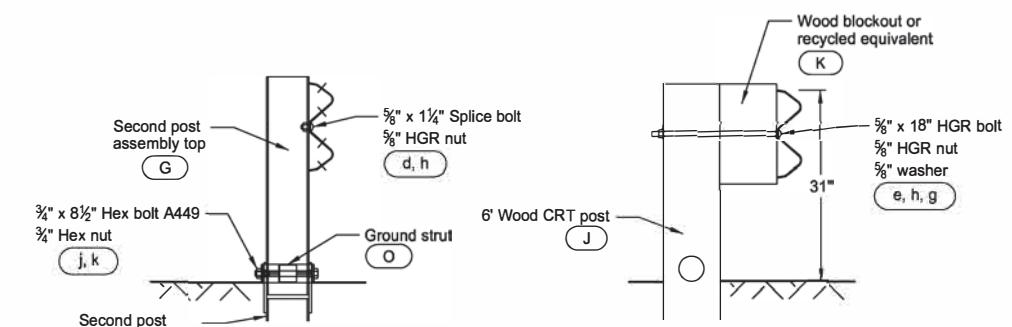
SECTION C-C

GENERAL NOTES:

1. Wood posts are required with the Flared Energy Absorbing Terminal except posts 1 and 2.
2. Galvanize all bolts, nuts, cable assemblies, cable anchors, and bearing plates.
3. Flare the Flared Energy Absorbing Terminal when the approach guardrail is parallel with the roadway. When the approach guardrail is flared at 16:1 to 10:1, ensure the Flared Energy Absorbing Terminal has only the flare rate of the guardrail. When the guardrail flare is between 10:1 and 7:1, ensure the Flared Energy Absorbing Terminal is turned parallel to the roadway.
4. Site grade as necessary to ensure the lower sections of the posts do not protrude more than 4" above the ground (measured along a 5' cord).
5. Install the lower section of the hinged posts without the upper post attached. If the post is placed in a drilled hole, compact the backfill material to prevent settlement.
6. Install the breakaway cable assembly taut. Use a locking device (vice grips or channel lock pliers) to prevent cable from twisting when tightening nuts.
7. "Toe nail" the wood blockouts to the rectangular wood posts with two 20 penny galvanized nails to prevent them from turning when the wood shrinks.

ITEM	ITEM NO.	BILL OF MATERIALS	QTY
A	F3000	IMPACT HEAD	1
B	SF1303	W-BEAM GUARDRAIL END SECTION, 12 Ga	1
C	G12025	9'-4 1/2" MGS W-BEAM RAIL SECTION, 12 Ga	1
D	G1203A	12'-6" MGS W-BEAM RAIL SECTION, 12 Ga	2
E	UHP1A	FIRST POST ASSEMBLY TOP	1
F	HP1B	FIRST POST ASSEMBLY BOTTOM	1
G	UHP2A	SECOND POST ASSEMBLY TOP	1
H	HP2B	SECOND POST ASSEMBLY BOTTOM	1
J	UP671	WOOD CRT POST	5
K	P675	WOOD BLOCKOUT OR RECYCLE EQUIVALENT	5
L	E750	BEARING PLATE	1
M	S760	CABLE ANCHOR BOX	1
N	E770	BCT CABLE ANCHOR ASSEMBLY	1
O	S785	GROUND STRUT HINGED POST	1
		HARDWARE	
a	B5160304A	5/16" x 3" HEX BOLT A325	2
b	W0516	5/16" WASHER	4
c	N0516	5/16" HEX NUT	2
d	B580122	5/16" Dia x 1 1/4" SPLICE BOLT	33
e	B581802	5/16" Dia x 18" HGR BOLT	5
f	B580904A	5/16" Dia x 9" HEX BOLT GRD 5	1
g	W050	5/16" WASHER	7
h	N050	5/16" Dia HGR NUT	39
j	B340854A	3/4" Dia x 8 1/2" HEX BOLT GRD A449	1
k	N030	3/4" Dia HEX NUT	1
l	N100	1" ANCHOR CABLE HEX NUT	2
m	W100	1" ANCHOR CABLE WASHER	2
n	SB12A	1/2" RSI SHOULDER BOLT WITH WASHER	8
o	N012A	1/2" STRUCTURAL NUT	8
p	W012A	1/2" STRUCTURAL WASHER	8
r	CT-100ST	BEARING PLATE RETAINER TIE	1

NOTE: Standard wood line post, block, and associated hardware not included in Bill of Materials.



SECTION A-A
Post 2

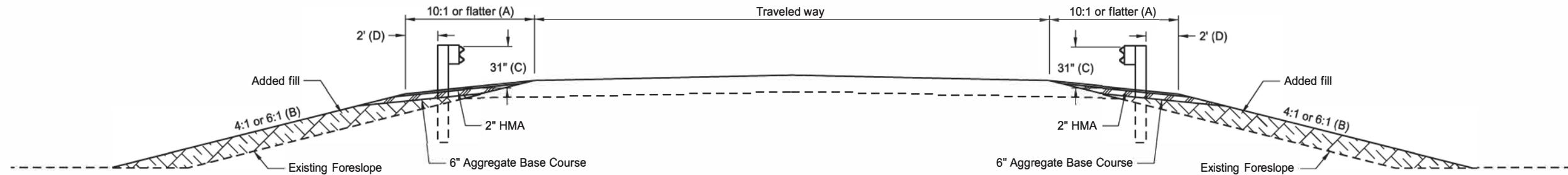
SECTION B-B
Posts 3 through 7

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
7-14-17	
REVISIONS	
DATE	CHANGE
12-02-20	Updated notes to active voice.

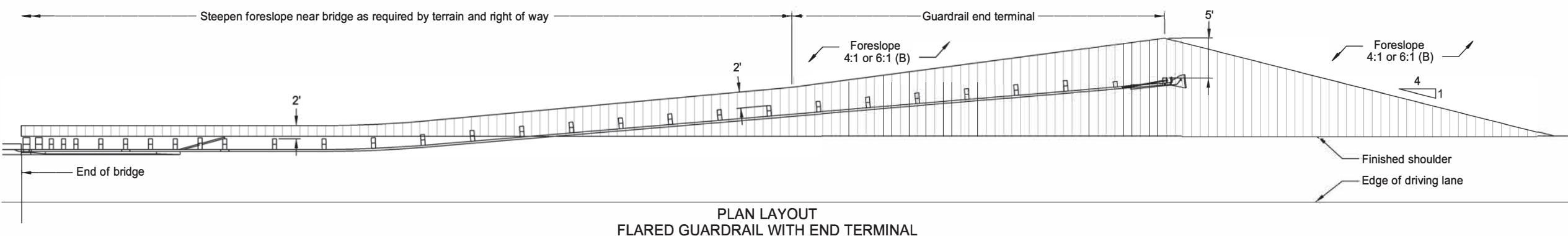
KIRK J. HOFF
REGISTERED
PROFESSIONAL
PE-4683
ENGINEER
NORTH DAKOTA
12 02 2020

TYPICAL GRADING AT BRIDGE ENDS
WITH MGS W-BEAM GUARDRAIL

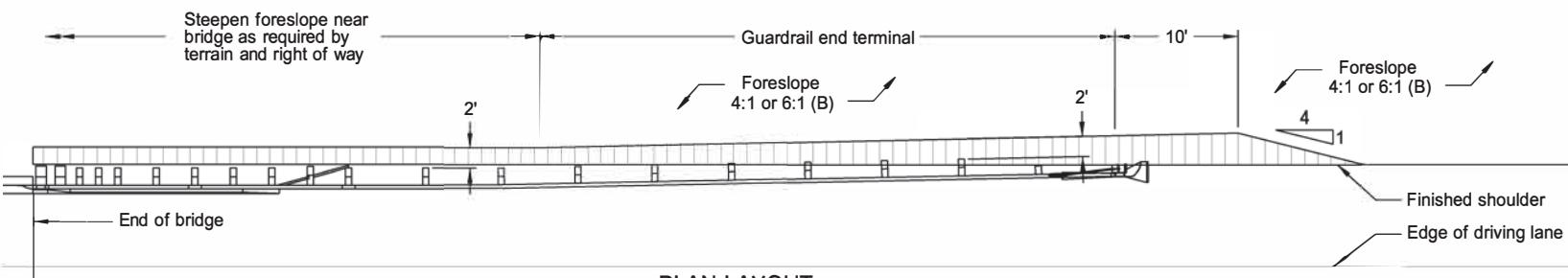
D-764-48



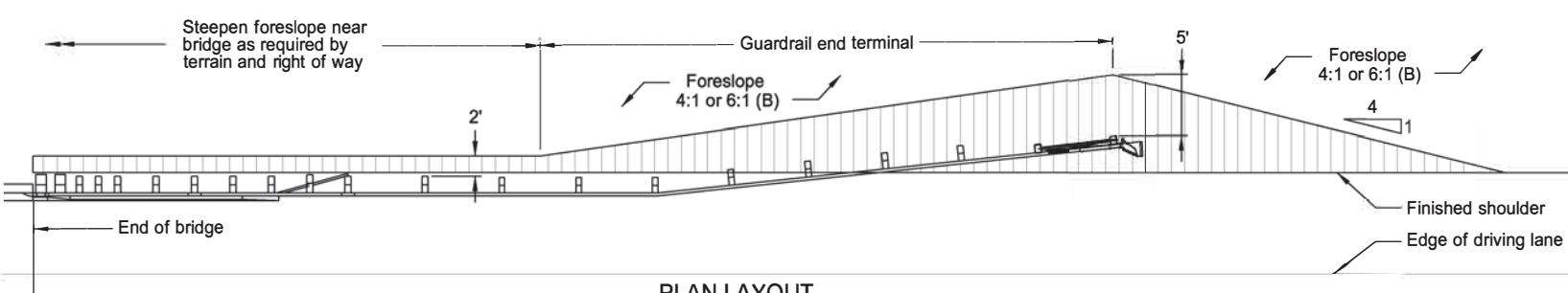
TYPICAL SECTION



PLAN LAYOUT
FLARED GUARDRAIL WITH END TERMINAL



PLAN LAYOUT
NON-FLARED GUARDRAIL WITH TANGENT END TERMINAL



PLAN LAYOUT
NON-FLARED GUARDRAIL WITH FLARED END TERMINAL

NOTES:

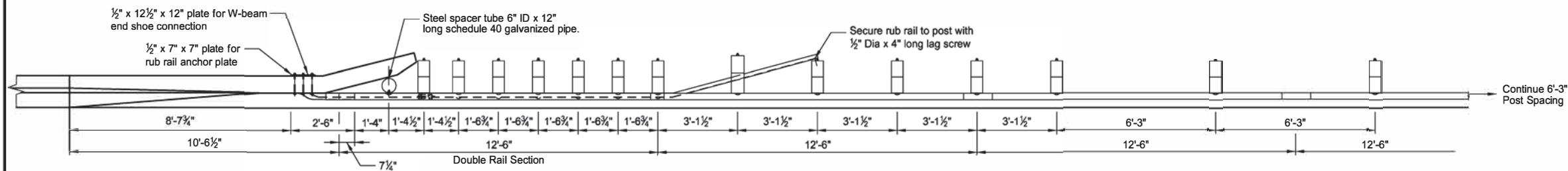
- (A) Use slope flatter than 10:1 when required to provide proper guardrail height.
- (B) When normal foreslope is 4:1, use added fill slope of 4:1. When normal foreslope is 6:1, use added fill slope of 6:1.
- (C) Measure from top of guardrail to top of surfacing at front face of guardrail.
- (D) Vary dimension at end terminals per Plan Layouts shown on this sheet.

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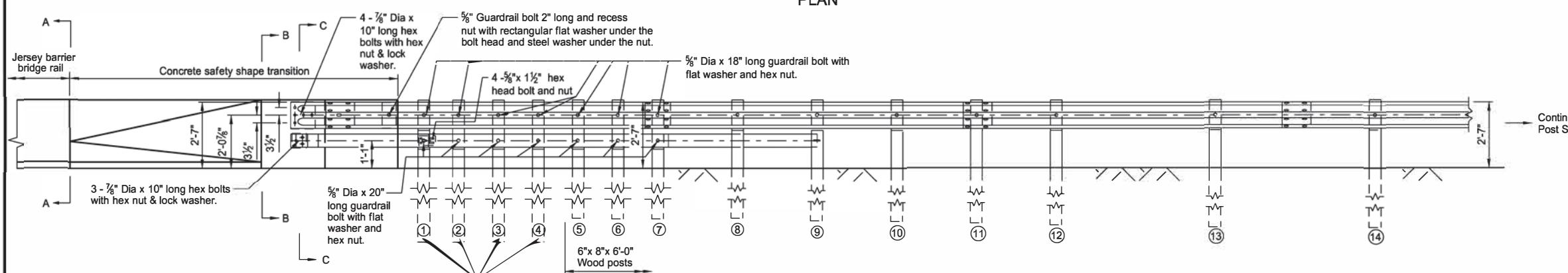


MGS W-BEAM TRANSITION TO CONCRETE SAFETY SHAPE TRANSITION

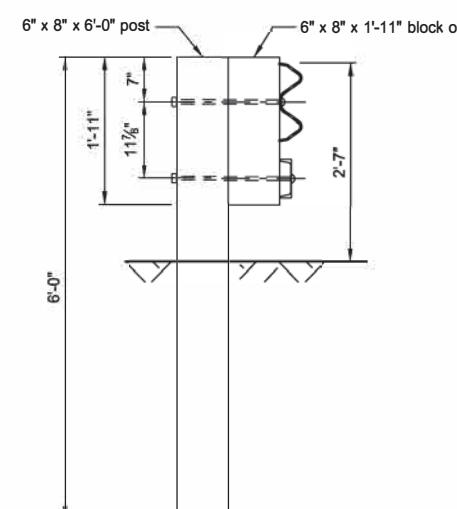
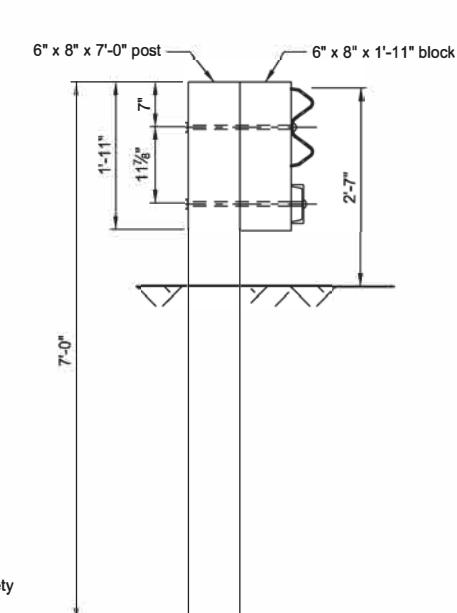
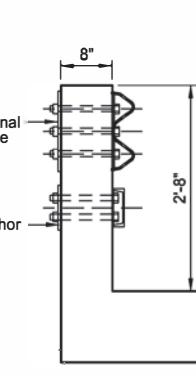
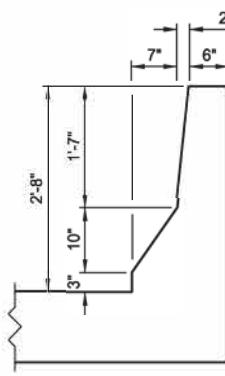
D-764-63



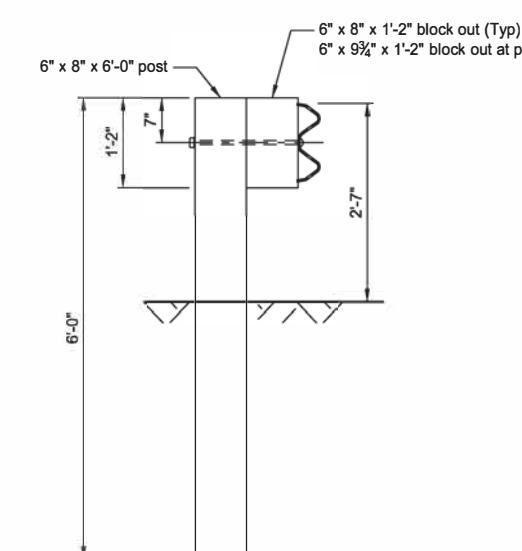
PLAN



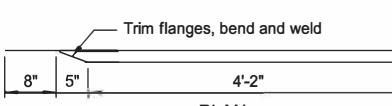
ELEVATION



Detail



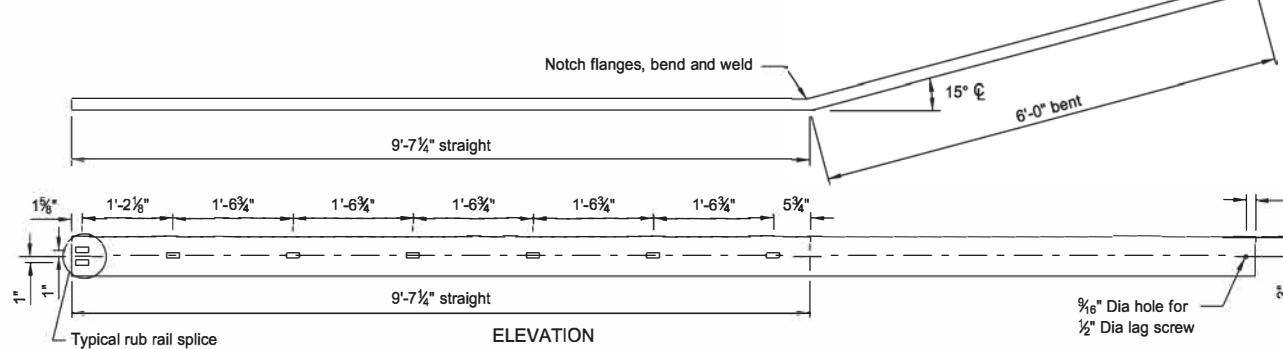
Detail



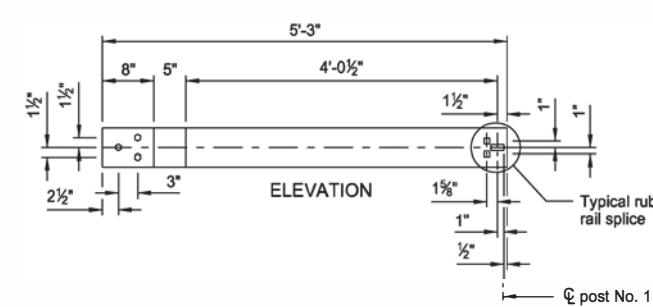
Trim flanges, bend and w

8" 5" 4'-2"

Flange



ELEVATION



C6 x 8.2 RUB BALL STRAIGHT SECTION

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12.02.2020